DSS-1

DIGITAL SAMPLING SYNTHESIZER
SERVICE MANUAL

CONTENTS

KORG®

1. SPECIFICATIONS

● **KEYBOARD:**	C ~ C 61 Keys, Velocity, After Touch
● **CONTROLLERS:**	Joystick (X Asix: OSC/VCF FC Bend, + Y Axis: OSC Modulation, − Y Axis: VCF Modulation), Program Up Jack, Sustain Damper Jack
● **CONFIGURATION:**	8 Voices, 16 Oscillators, (2 Oscillators per Voice), 8 VCF Modules, 8 VCA Modules
● **SOUND SOURCES:**	Waveforms Obtained by Sampling, 128 Harmonic Synthesis, or "Drawing" can be edited, assigned to sections of the keyboard and looped. 12-bit quantization. Sampling Frequencies and Times: 16KHz, 16s, 24KHz, 11s, 32KHz, 8s, 48KHz, 5.5s (can be used together as one sound source), Number of Keyboard Split Points: Up to 16
● **NUMBER OF SOUND SOURCES:**	Up to 16 in internal wave RAM, Up to 120 per Disk
● **EFFECTS:**	Digital Delay ×2, Equalizer HIGH & LOW (All Programmable)
● **NUMBER OF PROGRAMS:**	32 in memory, 128 on disk
● **BUILT-IN DISK DRIVE:**	Takes 3.5-inch, Double Sided, Double Density (1MB unformatted) Floppy Disks, 770K PCM Data Storage Capacity per Disk
● **SUPPLIED ACCESSORIES:**	Floppy Disks ×4, AC Power Cord
● **DIMENSIONS:**	1171 (W) × 436 (D) × 123 (H) mm
● **WEIGHT:**	18.5kg
● **OPTIONS:**	PS-1 PEDAL SWITCH, PS-2 PEDAL SWITCH, TWC-030 TWIN CABLE (3m), DS-1 DAMPER SWITCH, KH-1000 DYNAMIC STEREO HEADPHONES, HC-DSS HARD CASE, MIDI CABLE (7m/10m/12m), MF-2DD MICRO FLOPPY DISKS, SOUND PROGRAM LIBRARY

2. ERROR MESSAGES

Message	Meaning
Drive Not Ready./ Set Disk or CANCEL	There is no disk set in the drive. To cancel, hold down the CANCEL key for two seconds or more.
UNFORMATED./	The disk in the drive has not been formatted for the DSS-1. You must format the disk in the DSS-1 in order to use it in this drive.
PROTECTED./ (HARD)	Format, save, and delete functions can not be carried out because the disk's write protect tab is in the protect or write disable (read only) position. Reset the tab to the write enable (read/write) position. Then try again.
PROTECTED./ (SOFT)	The disk is set to the write protect mode, so you can not perform save or delete operations. Use disk utility mode F1 to reset the protection, then try again.
DISK FULL./	Free area on the disk is insufficient to store the sounds or multisounds that you are trying to save. Or, the save procedure will cause the number of sounds and multisounds to exceed the limits of the disk. In either case, you can delete sounds or multisounds from the disk to make space, or you can save to a different disk.
SYSTEM Incompleted	An incomplete system has been loaded because a multisound or multisounds that were supposed to be in the system were not found on the disk. Check the relationships (dependencies) between the programs and multisounds. This message may appear also if there is a data error in the MIDI parameters or multisound list. Refer to the DATA ERROR message.

Message	Meaning
NO M.SNDS EXIST	There are no multisounds in the system. In other words, the system has not been finished.
NO SOUNDS	There is not a single sound on the disk.
NO M.SNDS	There is not a single multisound on the disk.
NO FILE./	The multisound or sound that you tried to get does not exist on that disk.
DATA ERROR./	Data written or read from disk is garbled and meaningless. Most data errors are caused by dirt on the disk or damage to the disk. This problem also occurs if the disk and the drive are not very compatible or if the drive heads are dirty. If this message appears when getting data, try taking out the disk, inserting it again, and then repeating the get procedure several times. If this message appears when saving data, there is a danger of corrupting other data on that disk, so use a new disk to save the data. Use the old disk for getting data only. * To clean the heads, insert a commercially available dual sided head cleaning disk and perform the sound directory function two or three times.

3. MIDI IMPLEMENTATION

1 TRANSMITTED DATA

1-1 CHANNEL MESSAGES

STATUS	SECOND	THIRD	DESCRIPTION
1000 nnnn	0kkk kkkk	0100 0000	Note Off kkk kkkk=36-96(NO KEY TRANSPOSE) =30-101(KEY TRANSPOSE)
1001 nnnn	0kkk kkkk	0vvv vvvv	Note On kkk kkkk=36-96(NO KEY TRANSPOSE) =30-101(KEY TRANSPOSE) vvv vvvv=14-127(7 bit resolution)
1011 nnnn	0000 0001	0vvv vv00	OSC Modulation vv vv00=0-124(5 bit resolution)
1011 nnnn	0000 0010	0vvv vv00	VCF Modulation vv vv00=0-124(5 bit resolution)
1011 nnnn	0100 0000	0000 0000	Damper Off
1011 nnnn	0100 0000	0111 1111	Damper On
1100 nnnn	0ppp pppp	.....	Program Change ppp pppp=0-127
1101 nnnn	0vvv vvv0	.....	Channel Pressure(After-Touch) vv vv0=0-126(6 bit resolution)
1110 nnnn	0000 0000	0bbb bbbb	Pitch Bender Change bbb bbbb=0-127(7 bit resolution)

★ nnnn=channel numbers 0 to 15
★ 0kkk kkkk: note number
If key transpose is used, then the transmitted note number is the transposed value (regular note range of 36 to 96 minus up to 6 or plus up to 5.
★ 0ppp pppp: program number
Program numbers are represented on the display by system programs according to this chart.

Display	Program number	Display	Program number	Display	Program number	Display	Program number
SYSA P01→	0	SYSB P01→	32	SYSC P01→	64	SYSD P01→	96
SYSA P02→	1	SYSB P02→	33	SYSC P02→	65	SYSD P02→	97
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
SYSA P31→	30	SYSB P31→	62	SYSC P31→	94	SYSD P31→	126
SYSA P32→	31	SYSB P32→	63	SYSC P32→	95	SYSD P32→	127

1-2 SYSTEM EXCLUSIVE MESSAGES

(1)DEVICE ID

BYTE	DESCRIPTION
1111 0000	Exclusive Status
0100 0010	KORG ID 42H
0011 nnnn	Format ID 3nH(n=ch)
0000 1011	DSS-1 ID 0BH
1111 0111	EOX

(2)DSS-1 SYSTEM EXCLUSIVE MESSAGES

BYTE	DESCRIPTION
1111 0000	Exclusive Status
0100 0010	KORG ID 42H
0011 nnnn	Format ID 3nH(n=ch)
0000 1011	DSS-1 ID 0BH
0fff ffff	Function ID
0ddd dddd	See 3
⋮	
0ddd dddd	
1111 0111	EOX

NOTE: FUNCTION ID
42H(Mode Data)
45H(Multi Sound List)
44H(Multi Sound Parameter Dump)
43H(PCM Data Dump)
46H(Program Name List)
40H(Program Parameter Dump)
23H(Data Load Completed)
24H(Data Load Error)
21H(Write Completed)
22H(Write Error)

2 RECOGNIZED RECEIVE DATA

2-1 CHANNEL MESSAGES

STATUS	SECOND	THIRD	DESCRIPTION
1000 nnnn	0kkk kkkk	0xxx xxxx	Note Off velocity will be ignored.
1001 nnnn	0kkk kkkk	0vvv vvvv	Note On vvv vvvv=1-127(7 bit resolution)
1001 nnnn	0kkk kkkk	0000 0000	Note Off
1011 nnnn	0000 0001	0vvv vvvv	OSC Modulation vvv vvvv=0-127(7 bit resolution)
1011 nnnn	0000 0010	0vvv vvvv	VCF Modulation vvv vvvv=0-127(7 bit resolution)
1011 nnnn	0000 0111	0vvv vvvv	Volume vvv vvvv=0-127(7 bit resolution)
1011 nnnn	0100 0000	0vvv vvvv	Damper Off vvv vvvv=0-63
1011 nnnn	0100 0000	0vvv vvvv	Damper On vvv vvvv=64-127
1011 nnnn	0111 1010	0000 0000	Local Control Off
1011 nnnn	0111 1010	0111 1111	Local Control On
1011 nnnn	0111 1011	0000 0000	All Notes Off
1011 nnnn	0111 1100	0000 0000	Omni Mode Off
1011 nnnn	0111 1101	0000 0000	Omni Mode On
1100 nnnn	0ppp pppp	.....	Program Change
1101 nnnn	0vvv vvvv	.....	Channel Pressure(After-Touch) vvv vvvv=0-127(7 bit resolution)
1110 nnnn	0xxx xxxx	0bbb bbbb	Pitch Bender Change LSB will be ignored.

★ Mode messages are received only on the specified channel even if OMNI is on.
★ 0kkk kkkk = 0 to 127: note number
★ 0ppp pppp = 0 to 127: program number

The MIDI mode function 2 program change mode settings affect received program numbers as shown in this chart.

Receive program number / Program change mode.	MODE1	MODE2	MODE3	OFF
0-31	SYS A 1-32	SYS C 1-32	Current 1-32	No Change
32-63	SYS B 1-32	SYS D 1-32	Current 1-32	No Change
64-95	SYS C 1-32	SYS A 1-32	Current 1-32	No Change
96-127	SYS D 1-32	SYS B 1-32	Current 1-32	No Change

2-2 SYSTEM REAL TIME MESSAGE

BYTE	DESCRIPTION
1111 1110	Active Sensing

2-3 SYSTEM EXCLUSIVE MESSAGES

(1)DEVICE ID REQUEST

BYTE	DESCRIPTION
1111 0000	Exclusive Status
0100 0010	KORG ID 42H
0100 nnnn	Format ID 4nH(n=ch)
1111 0111	EOX

(2)DSS-1 SYSTEM EXCLUSIVE MESSAGES

BYTE	DESCRIPTION
1111 0000	Exclusive Status
0100 0010	KORG ID 42H
0011 nnnn	Format ID 3nH(n=ch)
0000 1011	DSS-1 ID 0BH
0fff ffff	Function ID
0ddd dddd	See 3
⋮	
0ddd dddd	
1111 0111	EOX

NOTE: FUNCTION ID

12H (Mode Request)
13H (Play Mode Request)
16H (Multi Sound List Request)
45H (Multi Sound List)
15H (Multi Sound Parameter Request)
44H (Multi Sound Parameter Dump)
14H (PCM Data Request)
43H (PCM Data Dump)
17H (Program Name List Request)
10H (Program Parameter Request)
40H (Program Parameter Dump)
41H (Program Parameter Change)
11H (Write Request)

3 DSS-1 SYSTEM EXCLUSIVE FORMAT

1. MODE REQUEST (FUNCTION ID = 12, RECEIVE ONLY)

FORMAT	DESCRIPTION
F0 42 3n 0B 12 F7	Mode Request

2. MODE DATA (FUNCTION ID = 42, TRANSMIT ONLY)

FORMAT	DESCRIPTION
F0 42 3n 0B 42 aa (1 byte) F7	Mode Data Header Mode Data (NOTE 1) EOX

NOTE 1: MODE DATA

00 (PLAY MODE)
01 (SAMPLE MODE)
02 (EDIT SAMPLE MODE)
03 (CREATE WAVE FORM MODE)
04 (MULTI SOUND MODE)
05 (MIDI MODE)
06 (SYSTEM MODE)
07 (DISK UTILITY MODE)
08 (PROGRAM PARAMETER MODE)

3. PLAY MODE REQUEST (FUNCTION ID = 13, RECEIVE ONLY)

FORMAT	DESCRIPTION
F0 42 3n 0B 13 F7	Play Mode Request

4. MULTISOUND LIST REQUEST (FUNCTION ID = 16, RECEIVE ONLY)

FORMAT	DESCRIPTION
F0 42 3n 0B 16 F7	Multi Sound List Request

5. MULTISOUND LIST (FUNCTION ID = N45, SAME FOR TRANSMIT AND RECEIVE)

FORMAT	DESCRIPTION
F0 42 3n 0B 45 aa (1 byte) bb……bb (14 bytes) ⋮ cc……cc (14 bytes) ss (1 byte) F7	Multi Sound List Header Number of Multi Sounds Multi Sound 1 Data (NOTE 1) ⋮ Last Multi Sound Data Check Sum (see 4-(3)) EOX

NOTE 1: MULTI SOUND DATA

FORMAT	DESCRIPTION
dd……dd (8 bytes) ee……ee (6 bytes)	Multi Sound Name (see 4-(4)) Multi Sound Length

6. MULTISOUND PARAMETER REQUEST (FUNCTION ID = 15, RECEIVE ONLY)

FORMAT	DESCRIPTION
F0 42 3n 0B 15 aa (1 byte) F7	Multi Sound Parameter Request Header Multi Sound No.-1 EOX

7. MULTISOUND PARAMETER DUMP (FUNCTION ID = 44, SAME FOR TRANSMIT AND RECEIVE)

FORMAT	DESCRIPTION
F0 42 3n 0B 44 aa (1 byte) bb……bb (8 byte) cc……cc (6 byte) dd (1 byte) ee (1 byte) ff……ff (36 bytes) ⋮ gg……gg (36 bytes) ss (1 byte) F7	Multi Sound Parameter Dump Header Multi Sound No.-1 Multi Sound Name (see 4-(4)) Multi Sound Length bit7-6: 01 (Loop On) 00 (Loop Off) bit5-bit0: Number of Sounds Max Interval (NOTE 1) Sound 1 Parameter (NOTE 2) ⋮ Last Sound Parameter Check Sum (see 4-(3)) EOX

NOTE 1: MAX INTERVAL

Sets maximum value obtained with following formula.
(The lower 7 bits of the twos complement.)

(Top key) - (Org key) + { -12 (16kHz), -7 (24kHz), 0 (32kHz), 5 (48kHz) }

NOTE 2: SOUND PARAMETER

FORMAT	DESCRIPTION
hh (1 byte) ii (1 byte) jj (1 byte) kk (1 byte) ll (1 byte) mm……mm (6 bytes) nn……nn (6 bytes) pp……pp (6 bytes) qq……qq (6 bytes) rr (6 bytes) tt (1 byte)	Top Key (MIDI Note No.) Original Key (MIDI Note No.) Relative Tune 1 (-63) ~ 127 (+63) Relative Level (1 ~ 64) Relative Cutoff (1 ~ 64) Sound Word Length Sound Start Address (see 4-(5)) Sound Length Loop Start Address (see 4-(5)) Loop Length bit7-6: 00 (Transpose), 01 (Non Transpose) bit5-bit0: Sampling Frequency 0 (32KHz) 1 (24KHz) 2 (16KHz) 3 (48KHz)

8. PCM DATA REQUEST (FUNCTION ID = 14, RECEIVE ONLY)

FORMAT	DESCRIPTION
F0 42 3n 0B 14 aa……aa (6 bytes) bb……bb (6 bytes) F7	PCM Data Request Header Start Address (Adsolute) Last Address + 1 (Absolute) EOX

9. PCM DATA DUMP (FUNCTION ID = 43, SAME FOR TRANSMIT AND RECEIVE)

FORMAT	DESCRIPTION
F0 42 3n 0B 43 aa……aa (6 bytes) bb……bb (6 bytes) cc……cc (2 bytes) ⋮ dd……dd (2 bytes) ss F7	PCM Data Dump Header Start Address (Absolute) Last Address + 1 (Absolute) PCM Data of Start Address (see 4-(2)) ⋮ PCM Data of Last Address Check Sum (see 4-(3)) EOX

10. PROGRAM NAME LIST REQUEST (FUNCTION ID = 17, RECEIVE ONLY)

FORMAT	DESCRIPTION
F0 42 3n 0B 17 F0	Program Name List Request

11. PROGRAM NAME LIST (FUNCTION ID = 46, TRANSMIT ONLY)

FORMAT	DESCRIPTION
F0 42 3n 0B 46 aa……aa (8 bytes) ⋮ bb……bb (8 bytes) F7	Program Name List Header Program Name 1 (see[4]-(4)) ⋮ Program Name 32 EOX

12. PROGRAM PARAMETER REQUEST (FUNCTION ID = 10, RECEIVE ONLY)

FORMAT	DESCRIPTION
F0 42 3n 0B 10 aa (1 byte) F7	Program Parameter Request Header Program No.-1 (0~31) EOX

13. PROGRAM PARAMETER DUMP (FUNCTION ID = 40, TRANSMIT, RECEIVE)

FORMAT	DESCRIPTION
F0 42 3n 0B 40 aa……aa (80 bytes) [bb……bb (8 bytes)] F7	Program Parameter Dump Header Program Parameter (see[4]-(6)) Program Name (receive time only) EOX

★ Program Name not sent.

14. PROGRAM PARAMETER CHANGE (FUNCTION ID = 41, RECEIVE ONLY)

FORMAT	DESCRIPTION
F0 42 3n 0B 41 aa (1 byte) bb[bb] (1~2bytes) F7	Program Parameter Change Header Parameter No.(0~77) (see[4]-(6)) Parameter Value EOX

★ 2 bytes for params 46, 52.

15. WRITE REQUEST (FUNCTION ID = 11, RECEIVE ONLY)

FORMAT	DESCRIPTION
F0 42 3n 0B 11 aa (1 byte) F7	Write Request Header Write Program No.-1 (0~31) EOX

16. WRITE COMPLETED (FUNCTION ID = 21, SEND ONLY)

FORMAT	DESCRIPTION
F0 42 3n 0B 21 F7	Write Completed

17. WRITE ERROR (FUNCTION ID = 22, SEND ONLY)

FORMAT	DESCRIPTION
F0 42 3n 0B 22 F7	Write Error

18. DATA LOAD COMPLETED (FUNCTION ID = 23, SEND ONLY)

FORMAT	DESCRIPTION
F0 42 3n 0B 23 F7	Data Load Completed

19. DATA LOAD ERROR (FUNCTION ID = 24, SEND ONLY)

FORMAT	DESCRIPTION
F0 42 3n 0B 24 F7	Data Load Error

[4]DATA FORMAT REFERENCE

(1)ADDRESS, LENGTH DATA FORMAT (6 Bytes)

1st Byte	0	b7	b6	b5	b4	b3	b2	b1
2nd	0	b0	–	–	–	–	–	–
3rd	0	b16	b14	b13	b12	b11	b10	b9
4th	0	b8	–	–	–	–	–	–
5th	0	–	–	–	–	–	b18	b17
6th	0	b16	–	–	–	–	–	–

b0=LSB b18=MSB – : Not Used
0~261885 (address), 1~261886 (length)

(2)PCM DATA FORMAT (2 Bytes)

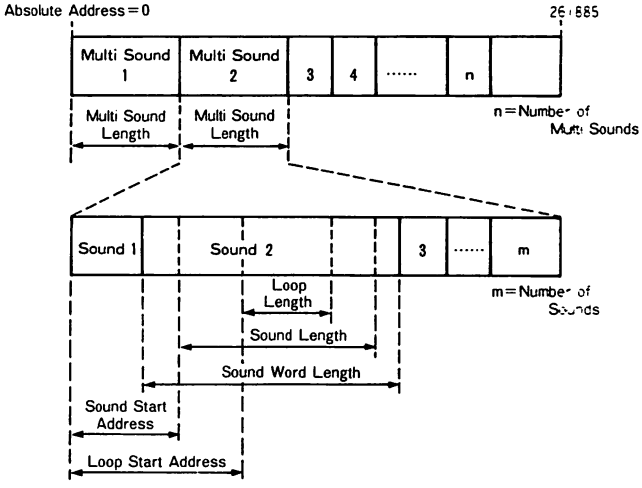
1st Byte	0	b4	b3	b2	b1	b0	–	–
2nd Byte	0	b11	b10	b9	b8	b7	b6	b5

b0=LSB b11=MSB – : Not Used
0(-max) -2048(0) -4095(+max)

(3)CHECK SUM (1 Byte)
Lower 7 bits of sum of data after function ID to before check sum.

(4)NAME FORMAT (8 bytes)
1st byte = 1st character; 8th byte = 8th character. All characters must be 7-bit ASCII in the range of 20H to 7FH, excluding 22H, 2AH, and 3FH.

(5)PCM DATA MEMORY MAP



★ The multisound parameter SOUND START address and LOOP START address values are different from those displayed by the DSS-1. They are rather the relative address values from the starting address.

★ Absolute addresses are used in the PCM data dump.

(6)DSS-1 PROGRAM PARAMETER MAP

PROGRAM PARAMETER	PARAMETER No. (NOTE 1)	OFFSET (NOTE 1)	VALUE RANGE (DECIMAL)
OSC 1 MIX RATIO (F14)	0	0	0~100(NOTE 2)
OSC 2 MIX RATIO (F14)	1	1	0~100(NOTE 2)
AUTO BEND INTENSITY (F19)	2	2	0~127
NOISE LEVEL (F21)	3	3	0~63
VCF MODE (F31)	4	4	0(12dB) 1(24dB)
VCF EG POLARITY (F31)	5	5	0(-) 1(+)
VCF CUTOFF (F32)	6	6	0~127
VCF EG INTENSITY (F32)	7	7	0~63
VCF RESONANCE (F33)	8	8	0~63
VCF KBDTRACK (F33)	9	9	0~63
VCF MG-FREQUENCY (F34)	10	10	0~63
VCF MG-DELAY (F34)	11	11	0~63
VCF MG-INTENSITY (F34)	12	12	0~63
VCF EG-ATTACK (F35)	13	13	0~63
VCF EG-DECAY (F35)	14	14	0~63
VCF EG-BREAK POINT (F35)	15	15	0~63
VCF EG-SLOPE (F35)	16	16	0~63
VCF EG-SUSTAIN (F35)	17	17	0~63
VCF EG-RELEASE (F35)	18	18	0~63
VCA DECAY KBDTRACK (F37)	19	19	0~63 (0~63) 64~127(0~-63)
VCA TOTAL LEVEL (F36)	20	20	0~63
VCA EG-ATTACK (F38)	21	21	0~63
VCA EG-DECAY (F38)	22	22	0~63
VCA EG-BREAK POINT (F38)	23	23	0~63
VCA EG-SLOPE (F38)	24	24	0~63
VCA EG-SUSTAIN (F38)	25	25	0~63
VCA EG-RELEASE (F38)	26	26	0~63
VEL. SENS.-A. BEND INTENSITY (F41)	27	27	0~63
VEL. SENS.-VCF CUTOFF (F42)	28	28	0~63
VEL. SENS.-VCF EG ATTACK (F43)	29	29	0~63
VEL. SENS.-VCF EG DECAY (F43)	30	30	0~63
VEL. SENS.-VCF EG SLOPE (F43)	31	31	0~63
VEL. SENS.-VCA EG LEVEL (F44)	32	32	0~63
VEL. SENS.-VCA EG ATTACK (F45)	33	33	0~63
VEL. SENS.-VCA EG DECAY (F45)	34	34	0~63
VEL. SENS.-VCA EG SLOPE (F45)	35	35	0~63
AFT. TOUCH-OSC MG INTENSITY (F51)	36	36	0~15
AFT. TOUCH-VCF (MG/CUTOFF) (F52)	37	37	0~15
AFT. TOUCH-VCF PARAMETER SLCT. (F52)	38	38	0(MG) 1(CUTOFF)

PROGRAM PARAMETER	PARAMETER No. (NOTE 1)	OFFSET (NOTE 1)	VALUE RANGE (DECIMAL)
AFT. TOUCH-VCA LEVEL (F53)	39	39	0~15
JOYSTICK PITCH BEND RANGE (F61)	40	40	0~12
JOYSTICK VCF SWEEP (F62)	41	41	0(OFF) 1(ON)
EQUALIZER TREBLE (F65)	42	42	0~12(-4~+8)
EQUALIZER BASS (F65)	43	43	0~12(-4~+8)
DDL MG-A FREQ. (F71)	44	44	0~63
DDL MG-B FREQ. (F71)	45	45	0~63
DDL-1 TIME (LOW) (F81)	46	46	0~500(NOTE 3)
DDL-1 TIME (HIGH) (F81)		47	
DDL-1 FEEDBACK (F82)	47	48	0~15
DDL-1 EFFECT LEVEL (F83)	48	49	0~15
DDL-1 MG-A INTENSITY (F84)	49	50	0~63
DDL-1 MG-B INTENSITY (F84)	50	51	0~63
DDL-2 INPUT SELECT (F91)	51	52	0(DIRECT) 1(DDL-1)
DDL-2 TIME (LOW) (F92)	52	53	0~500(NOTE 3)
DDL-2 TIME (HIGH) (F92)		54	
DDL-2 FEEDBACK (F93)	53	55	0~15
DDL-2 EFFECT LEVEL (F94)	54	56	0~15
DDL-2 MG-A INTENSITY (F95)	55	57	0~63
DDL-2 MG-B INTENSITY (F95)	56	58	0~63
DDL-2 MOD. INVERT SW (F96)	57	59	0(NORMAL) 1(INVERT)
OSC 1 MULTI SOUND No. (F12)	58	60	0~15(1~16)
OSC 2 MULTI SOUND No. (F13)	59	61	0~15(1~16)
MAX OSC BEND RANGE	60	62	0~12(NOTE 4)
SYNC MODE SW (F16)	61	63	0(OFF) 1(ON)
D A RESOLUTION (F16)	62	64	0(6 bits) 1(7 bits) 2(8 bits) 3(10 bits) 4(12 bits)
OSC 1 OCTAVE (F11)	63	65	0(16') 1(8') 2(4')
OSC 2 OCTAVE (F11)	64	66	0(16') 1(8') 2(4')
OSC 2 DETUNE (F15)	65	67	0~63
OSC 2 INTERVAL (F15)	66	68	0~11
OSC MG SELECT (F17)	67	69	0(OFF) 1(OSC 1) 2(OSC 2) 3(BOTH)
OSC MG-FREQUENCY (F17)	68	70	0~31
OSC MG-INTENSITY (F17)	69	71	0~15

PROGRAM PARAMETER	PARAMETER No. (NOTE 1)	OFFSET (NOTE 1)	VALUE RANGE (DECIMAL)
OSC MG-DELAY (F17)	70	72	0~15
AUTO BEND SELECT (F18)	71	73	0(OFF) 1(OSC 1) 2(OSC 2) 3(BOTH)
AUTO BEND-POLARITY (F18)	72	74	0(DOWN) 1(UP)
AUTO BEND-TIME (F19)	73	75	0~31
UNISON DETUNE (F64)	74	76	0~7(1~8)
VEL. SENS.-OSC CHANGE (F46)	75	77	0~31
KEY ASSIGN MODE (F63)	76	78	0(POLY 2) 1(POLY 1) 2(UNISON)
UNISON VOICES (F64)	77	79	0(2) 1(4) 2(6) 3(8)

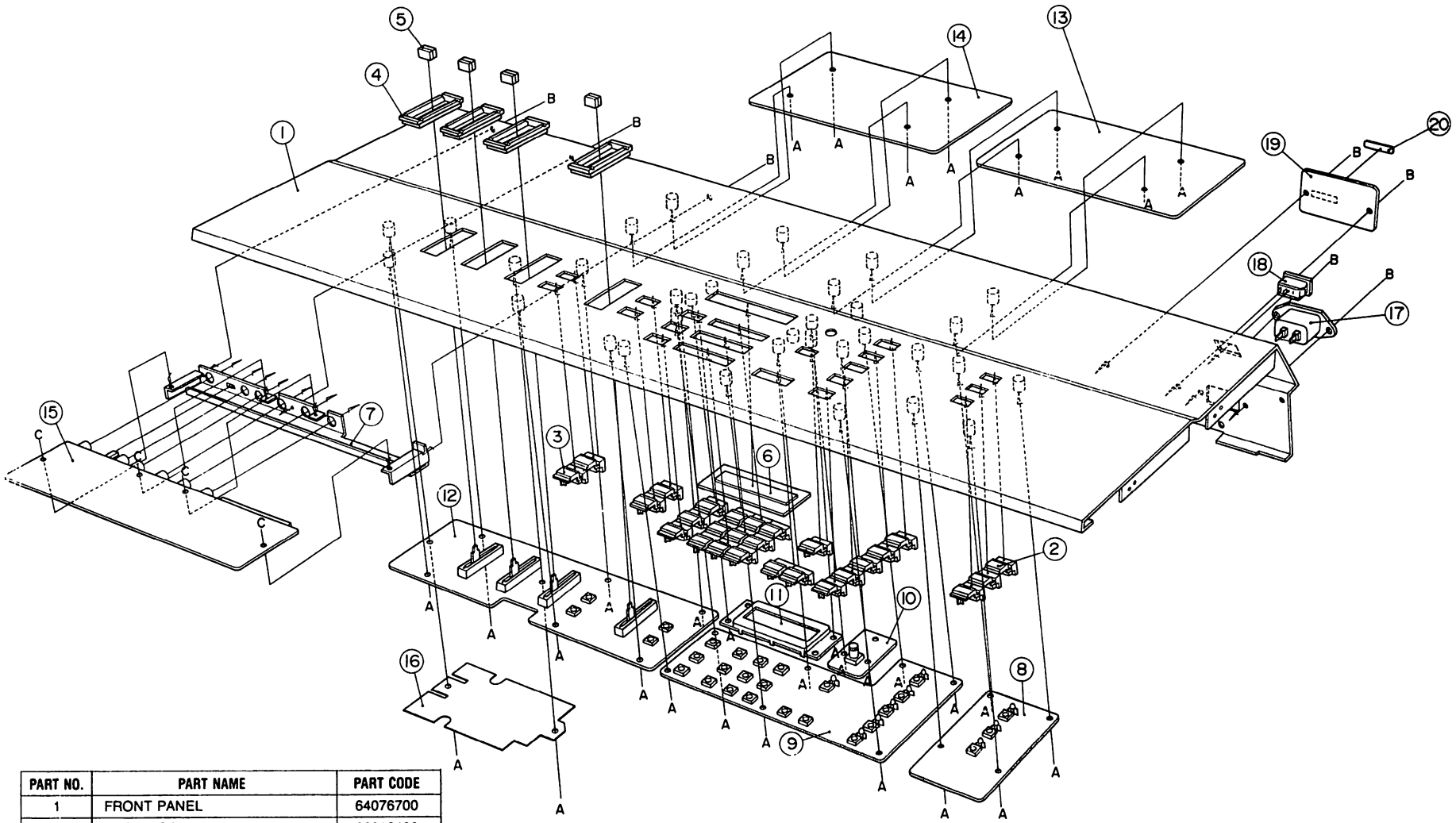
NOTE:

1. Parameter No.: Parameter number used for program parameter change.
   Offset: Byte offset within program parameter dump.
   Numbers within parentheses are parameter numbers used when editing within the DSS-1.
2. Must be set for both oscillators so that OSC1 + OSC2 = 100.

3. DDL TIME Format

LOW	0	b6	b5	b4	b3	b2	b1	b0
HIGH	0	0	0	0	0	0	b8	b7

4. The MAX BEND RANGE value is limited to the range of 0 to 12, derived by subtracting from 12 the larger MAX INTERVAL value of the multisounds assigned to OSC1 and OSC2. This must be reset if there is a change in the multisound MAX INTERVAL.

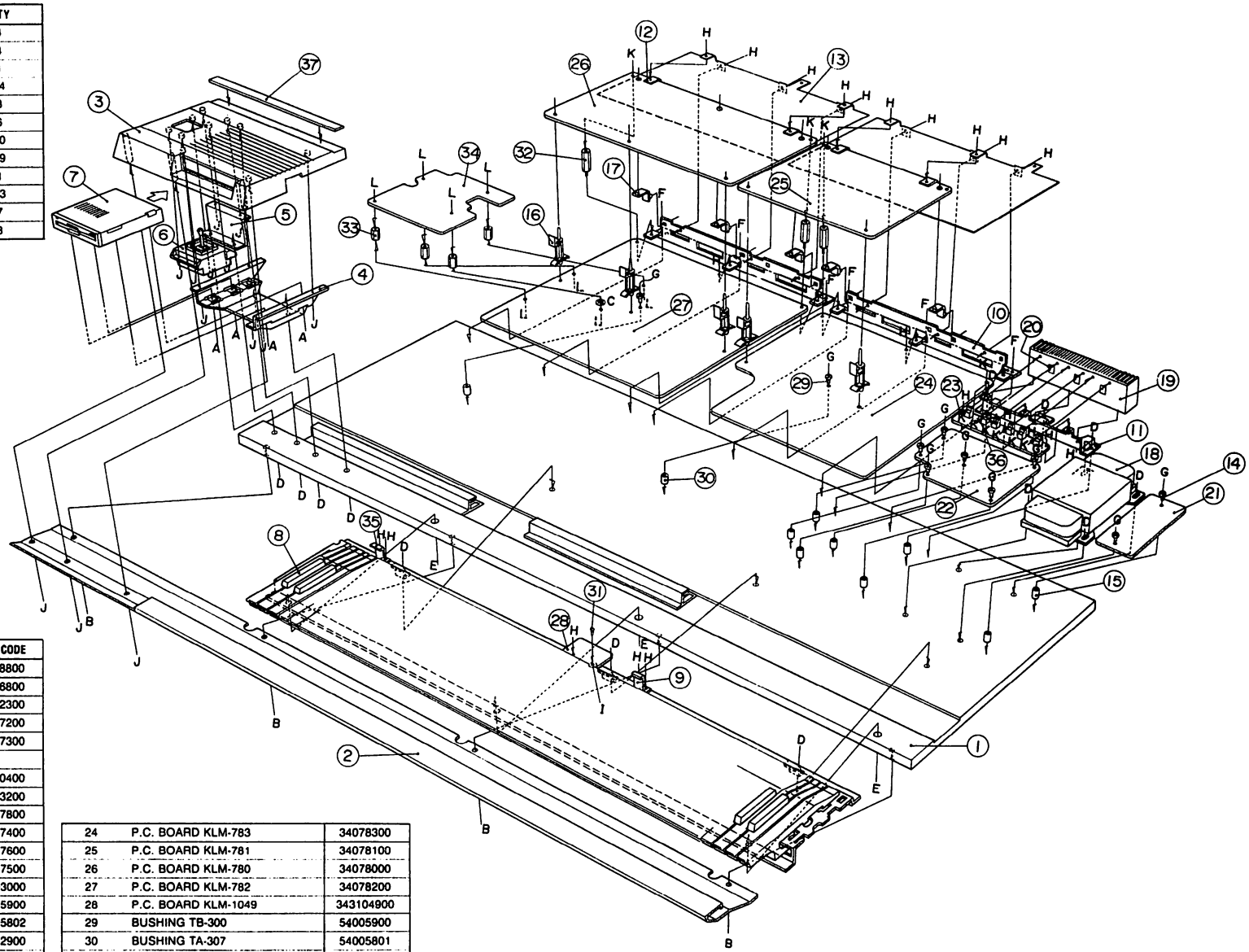


PART NO.	PART NAME	PART CODE
1	FRONT PANEL	64076700
2	NTS KNOB A	62016400
3	NTS KNOB B	62016600
4	SLIDE VR ESCUTCHEON	64622000
5	SLIDE VR KNOB	62016300
6	LCD WINDOW	63002900
7	JACK PLATE	64077000
8	P.C. BOARD KLM-1012	34078500
9	P.C. BOARD KLM-785	34078500
10	P.C. BOARD KLM-1031	34078500
11	LCD	31300300
12	P.C. BOARD KLM-784	34078400

13	P.C. BOARD KLM-1050 (1)	34310500
14	P.C. BOARD KLM-1050 (2)	34310500
15	P.C. BOARD KLM-788	34078800
16	SHIELDING SHEET (SMALL)	63003400
17	INLET SOCKET	54011100
18	POWER SW	37508000
19	NAME PLATE	68600700
20	SERIAL NO. SEAL	68599999

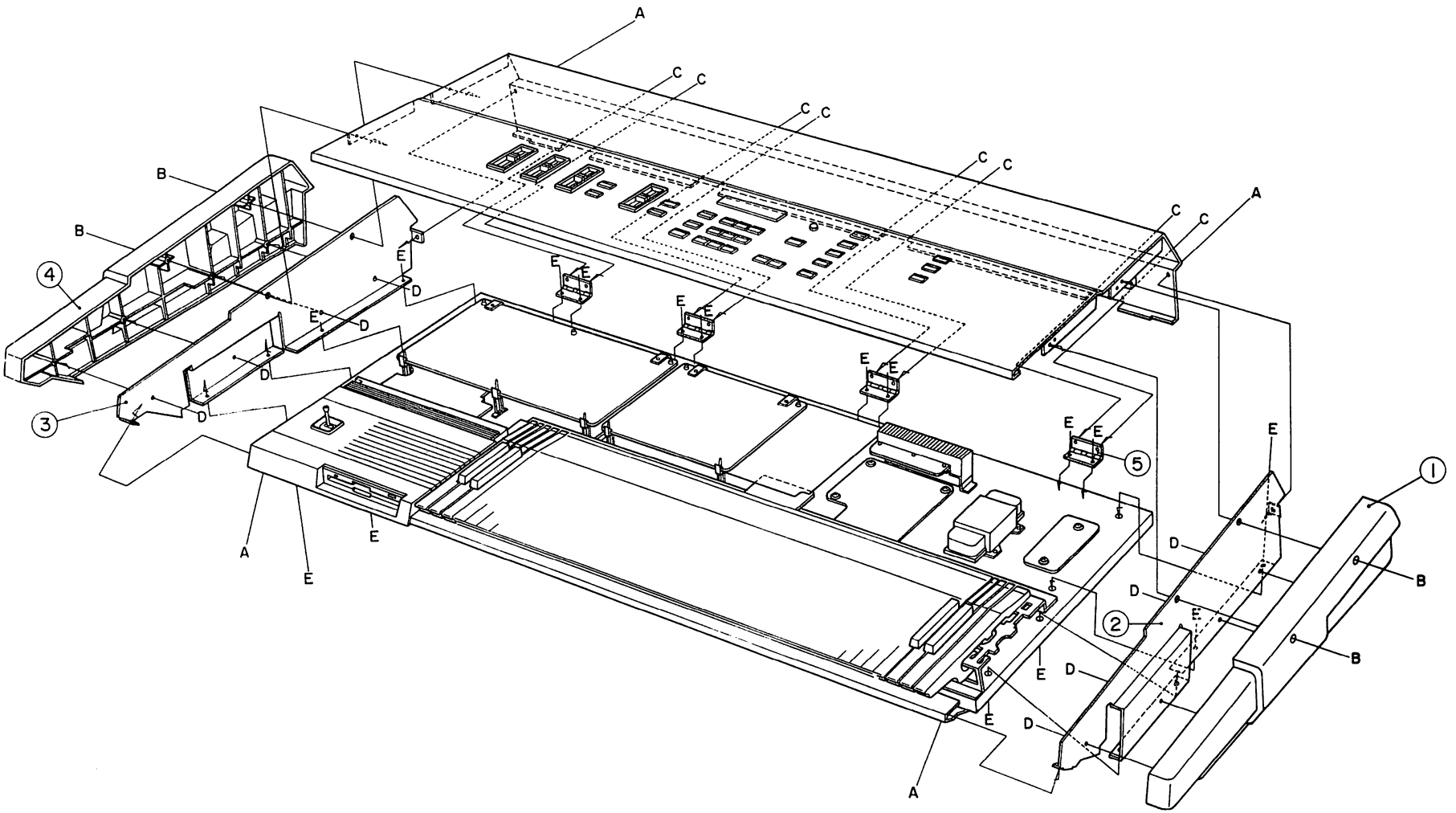
PART NO.	SCREWS	Q'TY
A	FE B ZMC 3×8	31
B	TP2G B BZMC 3×8	7
C	TP2G B ZMC 3×8	4

PART NO.	SCREWS, WASHERS	Q'TY
A	FE B ZMC 3 × 4	4
B	FE FEW BZCM 4 × 12	4
C	PSW 3	1
D	FE FEW BZMC 4 × 16	14
E	FE FEW BZMC 5 × 16	3
F	TP1 B ZMC 3 × 10	6
G	TP1 B ZMC 3 × 22	10
H	TP2G B ZMC 3 × 8	19
I	PSW 5	1
J	PLAX B BZMC 3 × 8	13
K	JE B ZMC 3 × 8	7
L	FE B ZMC 3 × 6	8



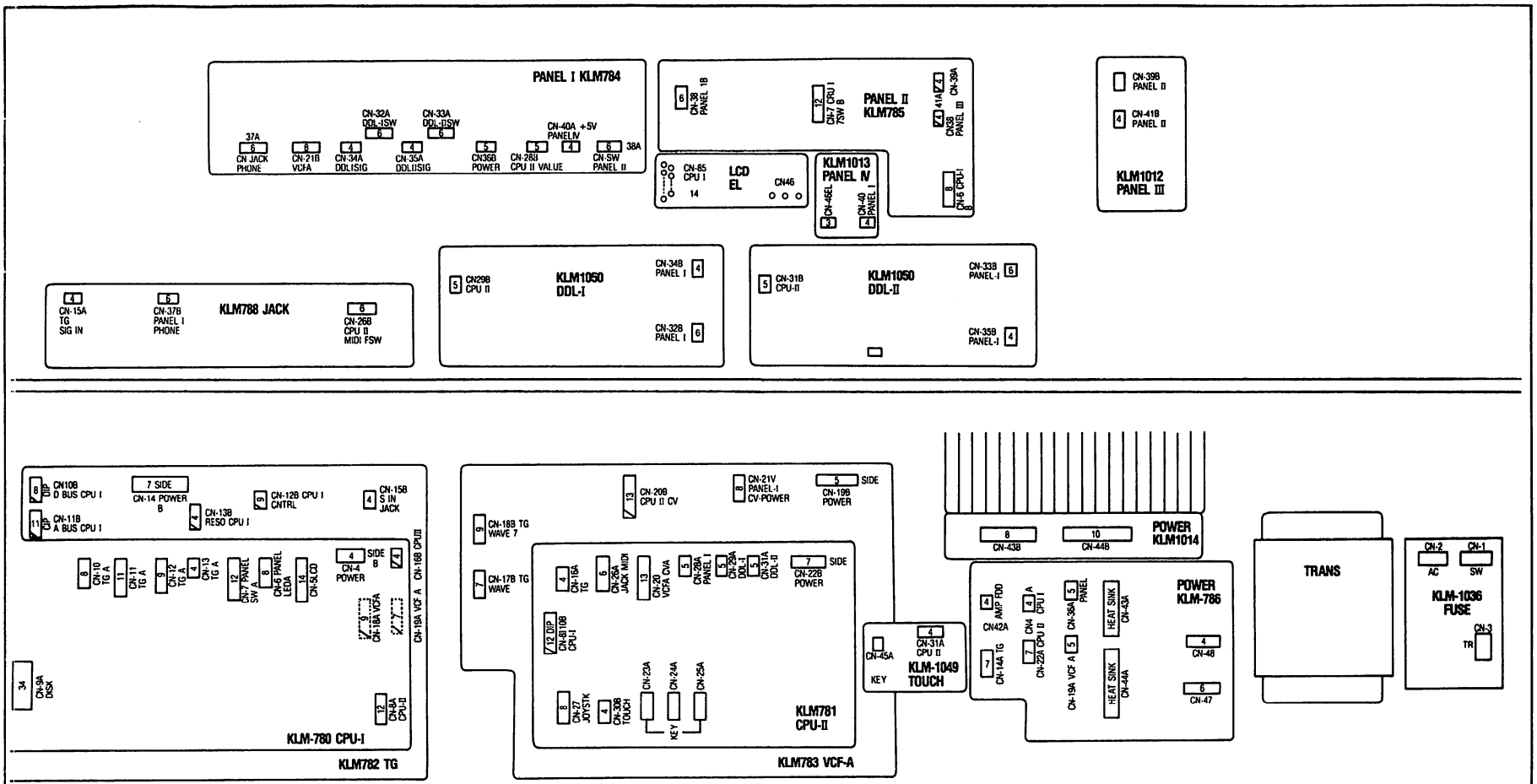
PART NO.	PART NAME	PART CODE
1	BOTTOM PLATE	64508800
2	FRONT CHASSIS	64076800
3	CONTROL PANEL	64622300
4	METAL FITTING OF FDD	64077200
5	CONTROL PANEL SUPPORT	64077300
6	JOY SITCK ASSEMBLY	
7	FDD	43500400
8	KBD	42003200
9	PANEL SUPPORT	64077800
10	METAL FITTINF OF P.C BOARD	64077400
11	RADIATION PLATE	64077600
12	GND CLIP	64077500
13	SHIELDING SHEET	63003000
14	BUSHING TB-300	54005900
15	BUSHING TA-310	54005802
16	P.C.B SPACER	54012900
17	P.C.B. HINGE	54012800
18	POWER TRANSFORMER	40010100
19	RADIATOR	56003600
20	RADIATION SHEET	56500300
21	P.C. BOARD KLM-1036	34310360
22	P.C. BOARD KLM-786	34078600
23	P.C. BOARD KLM-1041	34078600

24	P.C. BOARD KLM-783	34078300
25	P.C. BOARD KLM-781	34078100
26	P.C. BOARD KLM-780	34078000
27	P.C. BOARD KLM-782	34078200
28	P.C. BOARD KLM-1049	343104900
29	BUSHING TB-300	54005900
30	BUSHING TA-307	54005801
31	PUSH REVET	54012500
32	P.C. BOARD STUD NO.1	64079400
33	P.C. BOARD STUD NO.2	64079500
34	P.C. BOARD KLM-1061	34310610
35	FELT 8 × 25	55003800
36	ISOLATING WASHER	54007300
37	FELT FOR CONTROL PANEL	55008200

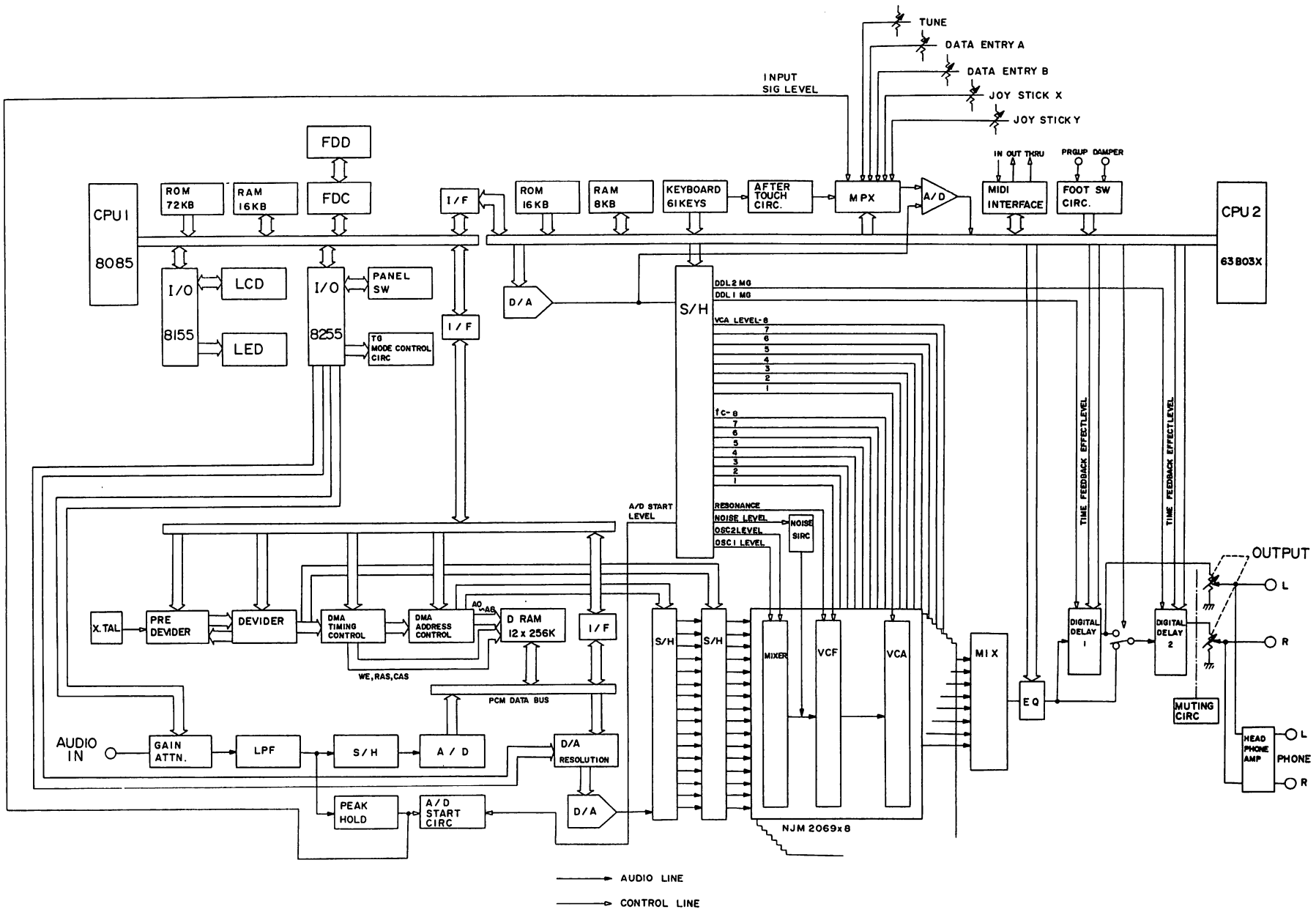


PART NO.	PART NAME	PART CODE
1	SIDE PANEL R	64622201
2	SIDE CHASSIS R	64077101
3	SIDE PANEL L	64622200
4	SIDE CHASSIS L	64077100
5	JOINT OF FRONT PANEL	64076900

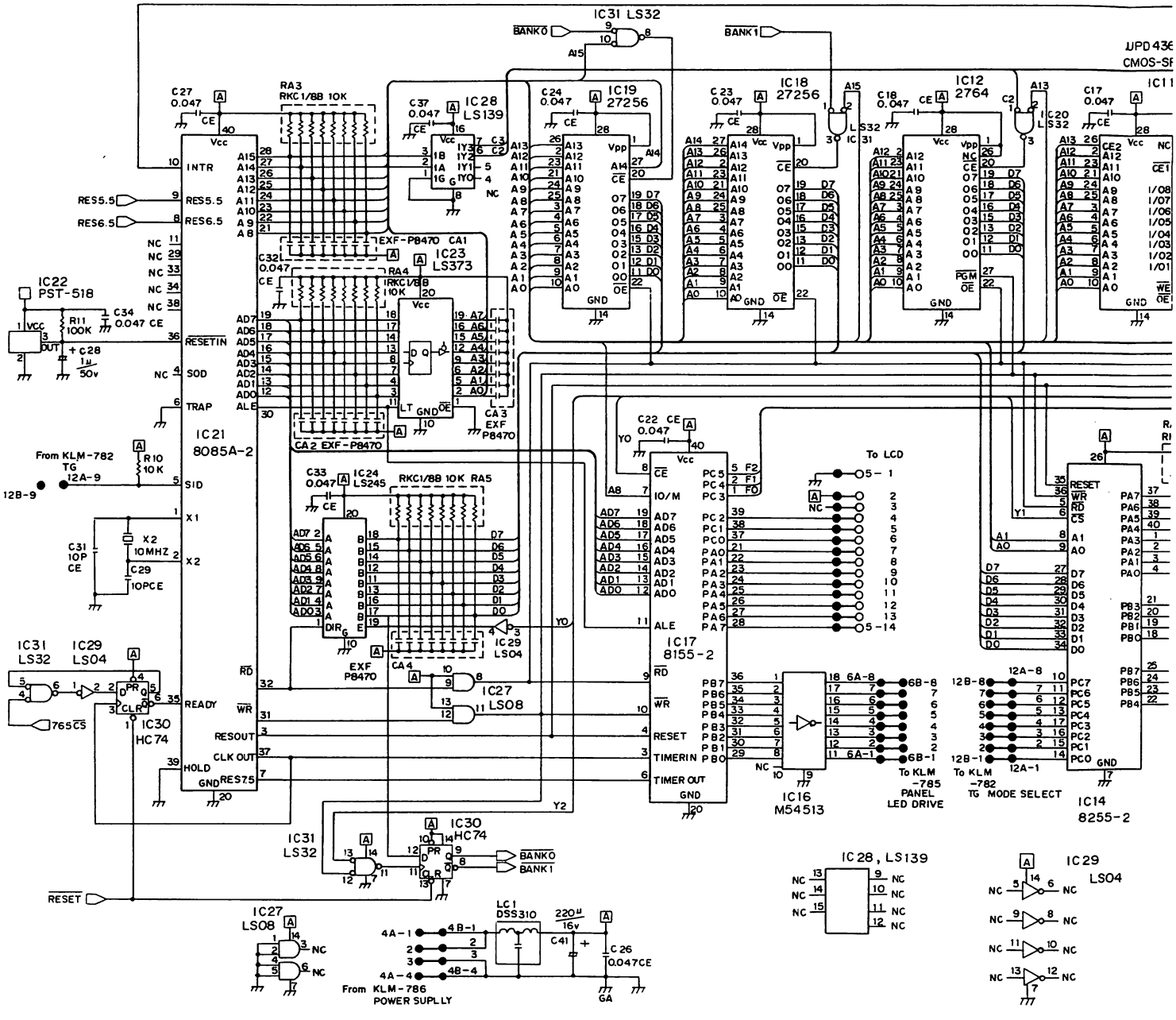
PART NO.	SCREWS	Q'TY
A	FE B BZMC 3×8	4
B	FE B BZMC 3×25	4
C	FE B BZMC 4×8	8
D	PLAX B BZMC 3×8	8
E	FE FEW BZMC 4×16	16

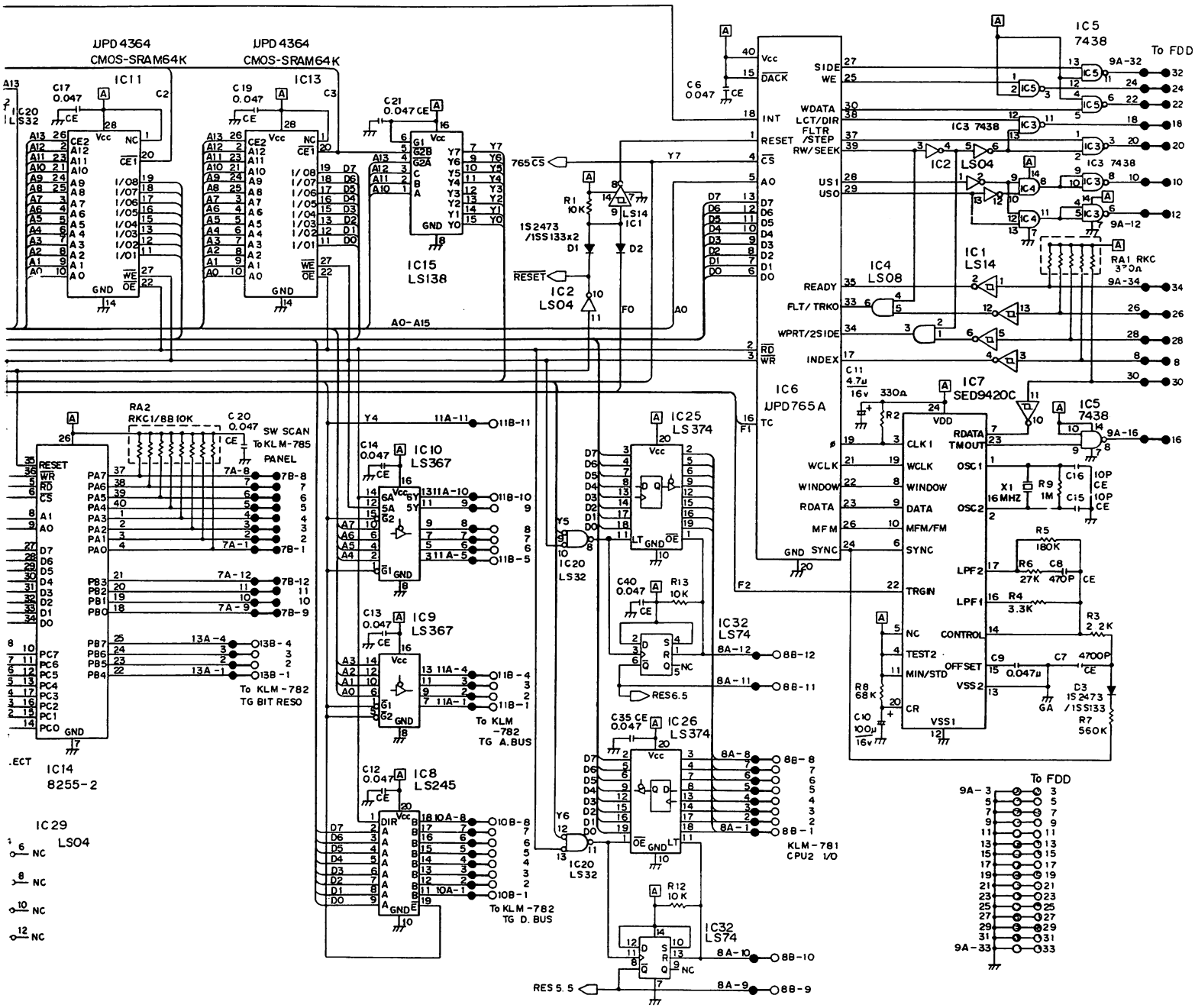


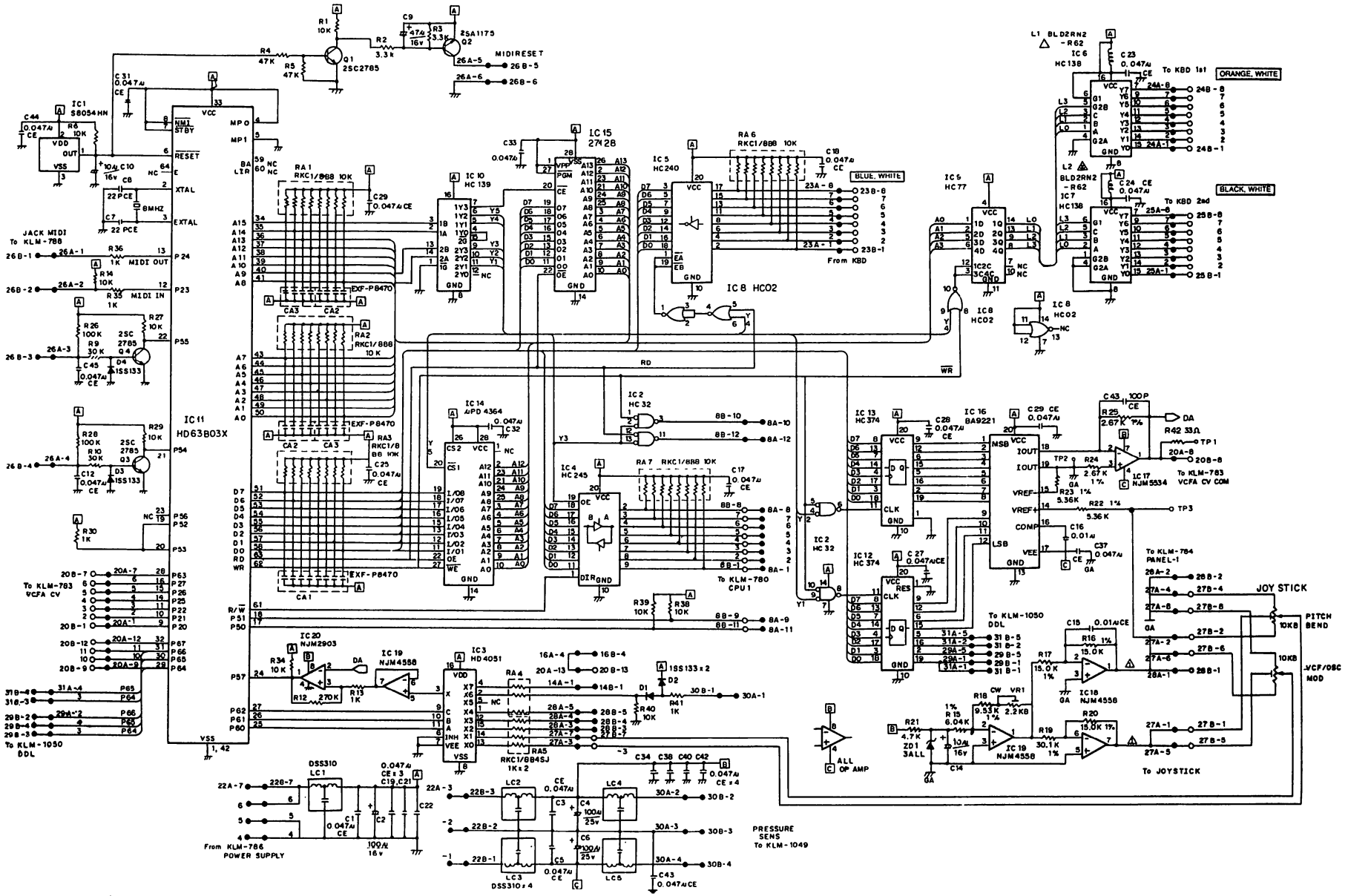
CN, 1	KLM-1036	POWER SW	CN, 12	KLM-782	KLM-780	CN, 23	KLM-781	KBD (BLU)	CN, 34	KLM-784	KLM-1050	CN, 45	KLM-1049	KBD
CN, 2	KLM-1036	AC SOCKET	CN, 13	KLM-780	KLM-782	CN, 24	KLM-781	KBD (OR)	CN, 35	KLM-784	KLM-1050	CN, 46	KLM-1013	LCD
CN, 3	KLM-1036	P.T	CN, 14	KLM-786	KLM-782	CN, 25	KLM-781	KBD (BL)	CN, 36	KLM-786	KLM-784	CN, 47	KLM-782	KLM-1016
CN, 4	KLM-786	KLM-780	CN, 15	KLM-788	KLM-782	CN, 26	KLM-781	KLM-788	CN, 37	KLM-788	KLM-784	CN, 48	KLM-782	KLM-1016
CN, 5	KLM-780	LCD BOARD	CN, 16	KLM-781	KLM-782	CN, 27	KLM-781	JOYSTIC	CN, 38	KLM-784	KLM-785	CN, 49	KLM-782	KLM-1016
CN, 6	KLM-780	KLM-785	CN, 17	KLM-783	KLM-0161	CN, 28	KLM-781	KLM-784	CN, 39	KLM-785	KLM-1012	CN, 50	KLM-782	KLM-1016
CN, 7	KLM-780	KLM-785	CN, 18	KLM-783	KLM-1061	CN, 29	KLM-781	KLM-1050	CN, 40	KLM-784	KLM-1013	CN, 51	KLM-1061	KLM-783
CN, 8	KLM-781	KLM-780	CN, 19	KLM-783	KLM-786	CN, 30	KLM-781	KLM-1049	CN, 41	KLM-785	KLM-1012	CN, 52	KLM-1061	KLM-783
CN, 9	KLM-780	FDD	CN, 20	KLM-783	KLM-783	CN, 31	KLM-781	KLM-1050	CN, 42	KLM-786	FDD	CN, 53	KLM-1061	KLM-782
CN, 10	KLM-780	KLM-782	CN, 21	KLM-783	KLM-784	CN, 32	KLM-784	KLM-1050	CN, 43	KLM-786	KLM-1014			
CN, 11	KLM-780	KLM-782	CN, 22	KLM-786	KLM-781	CN, 33	KLM-784	KLM-1050	CN, 44	KLM-786	KLM-1014			



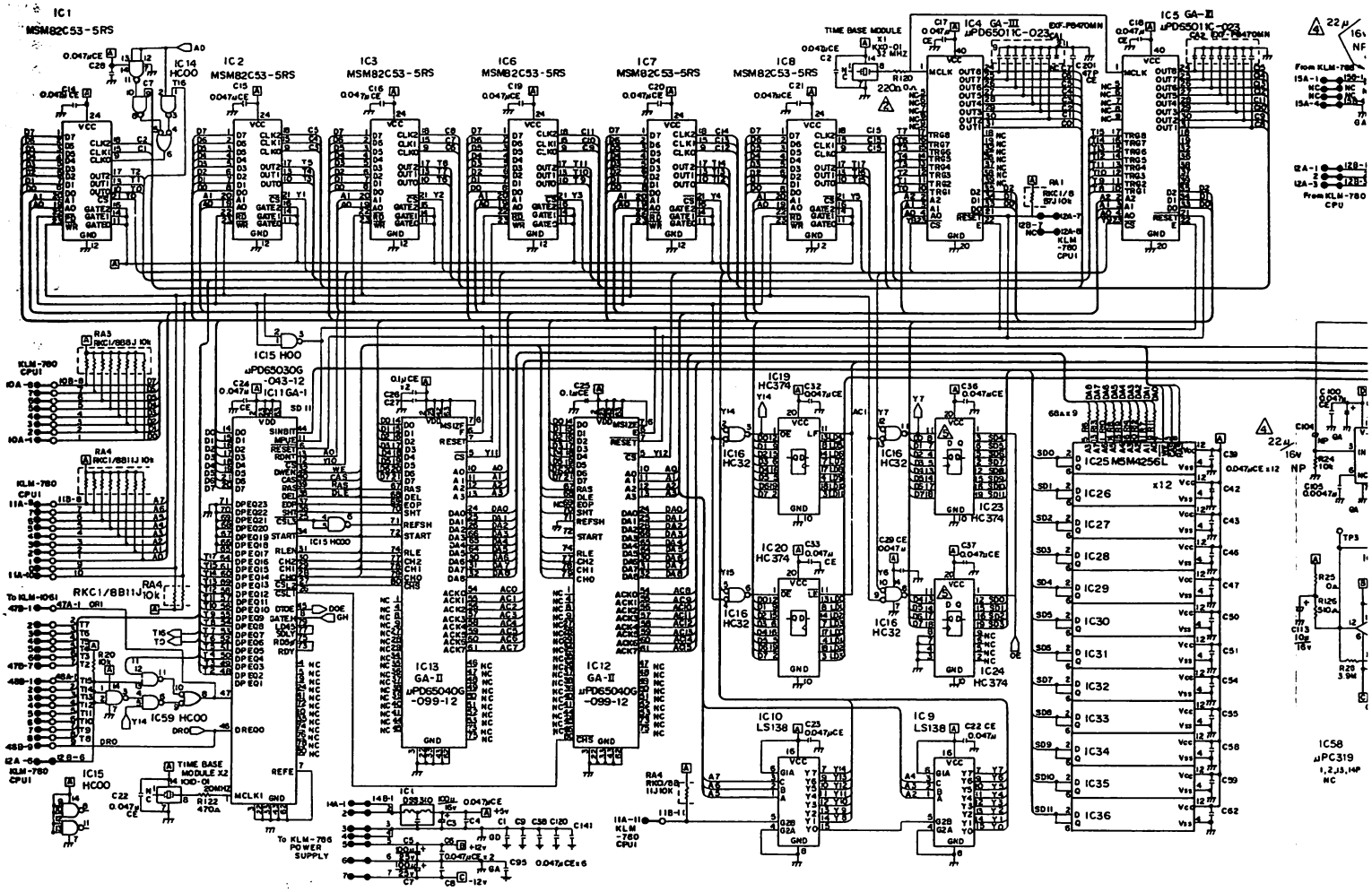
KLM-780

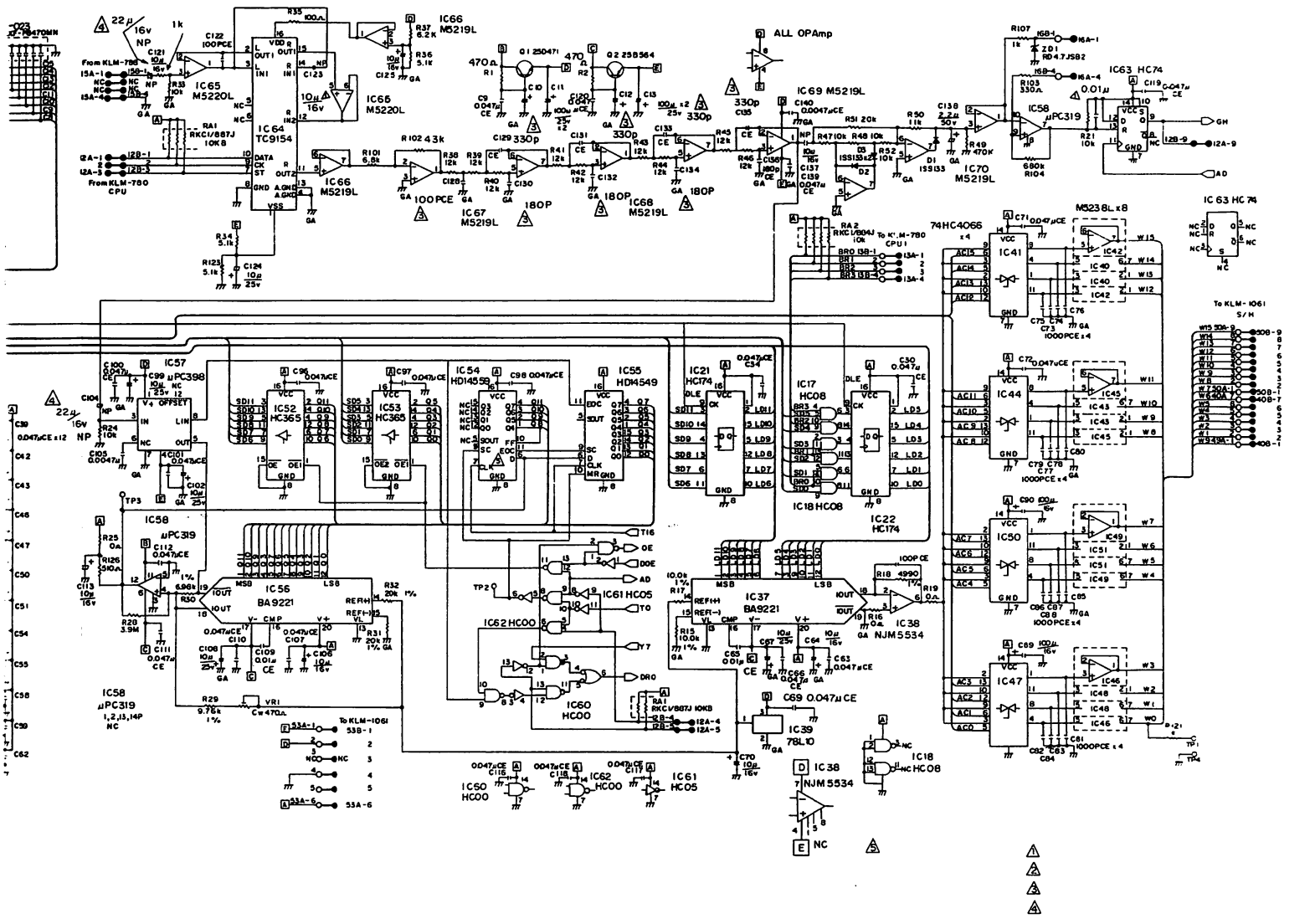






KLM-782





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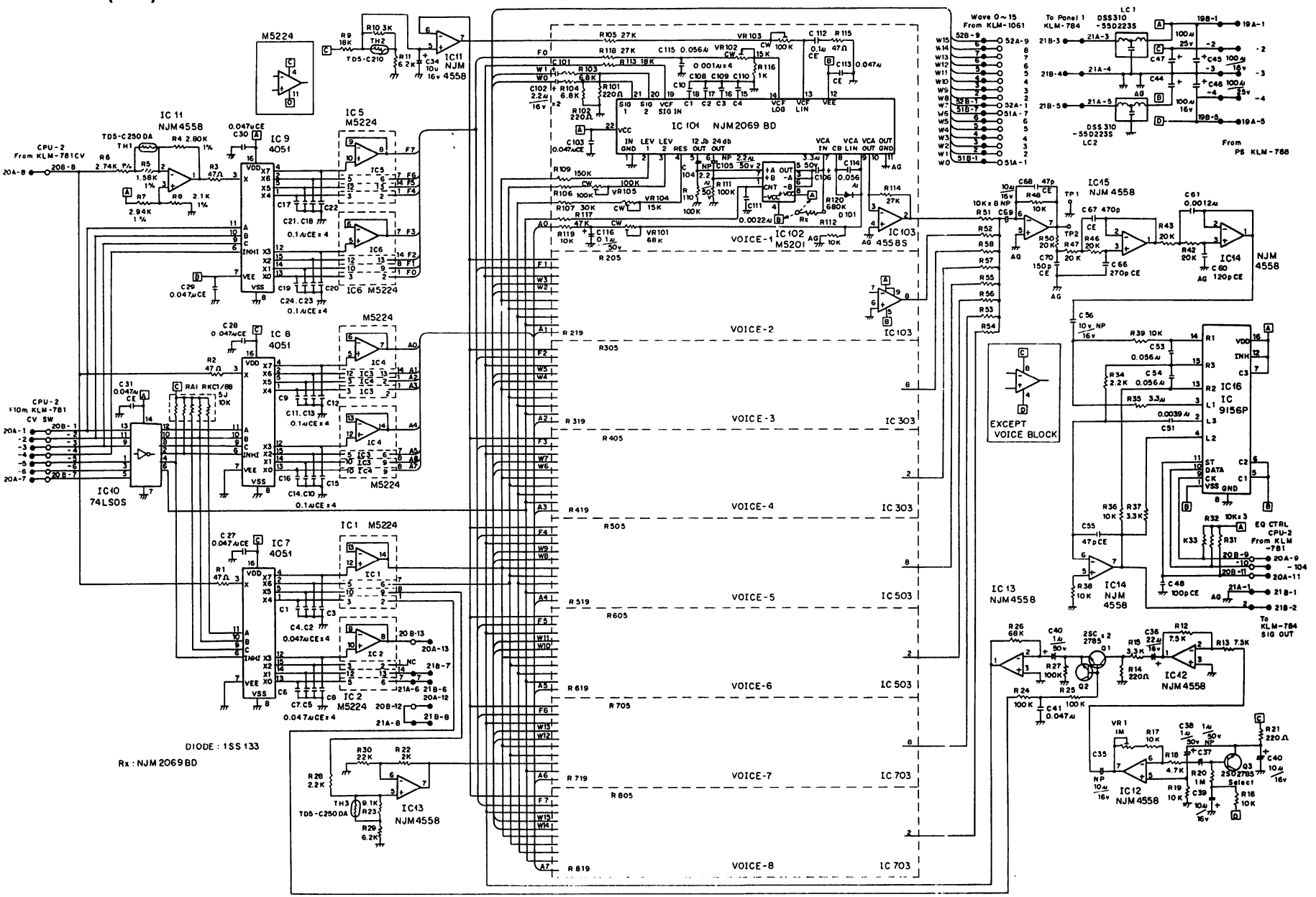

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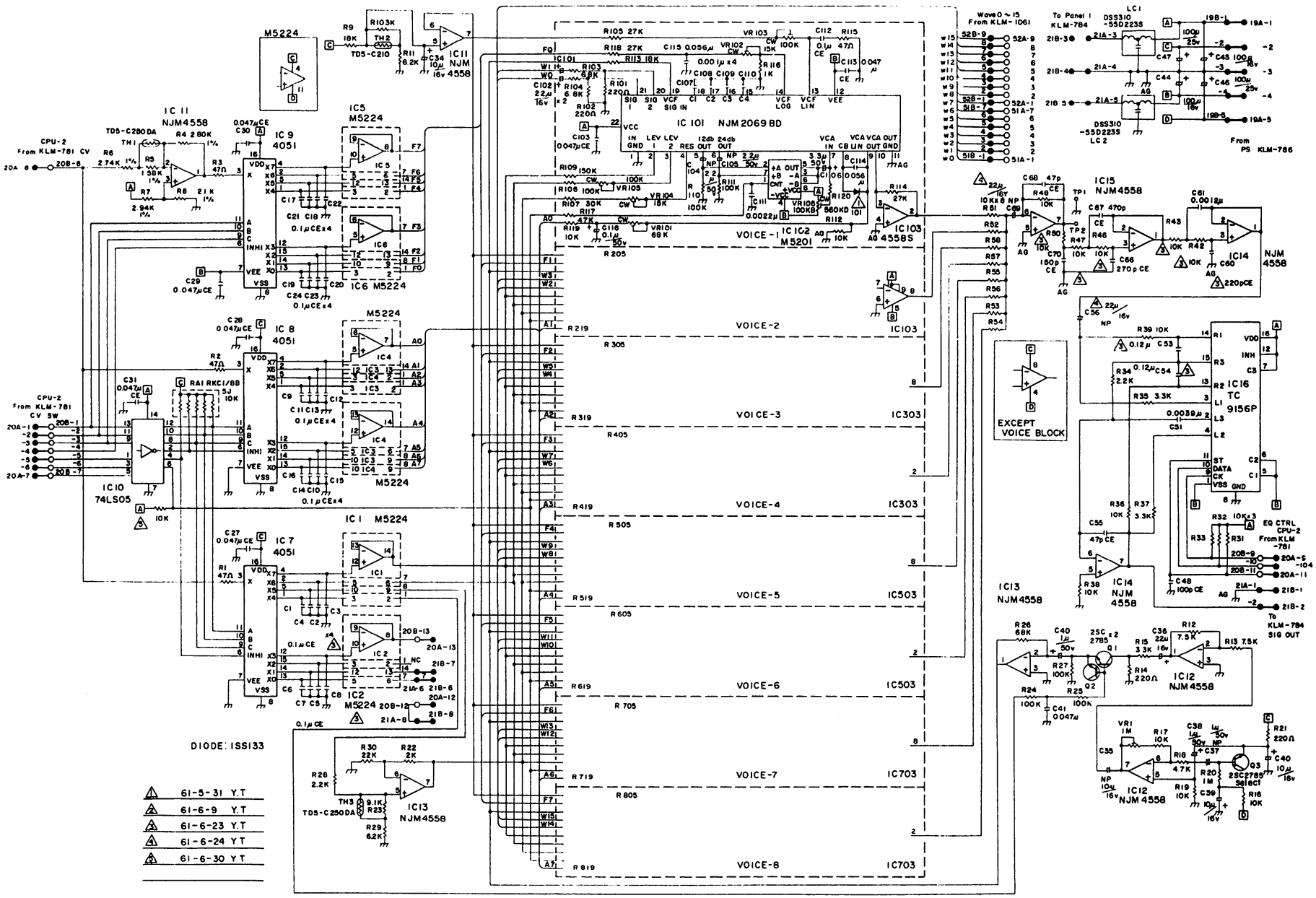
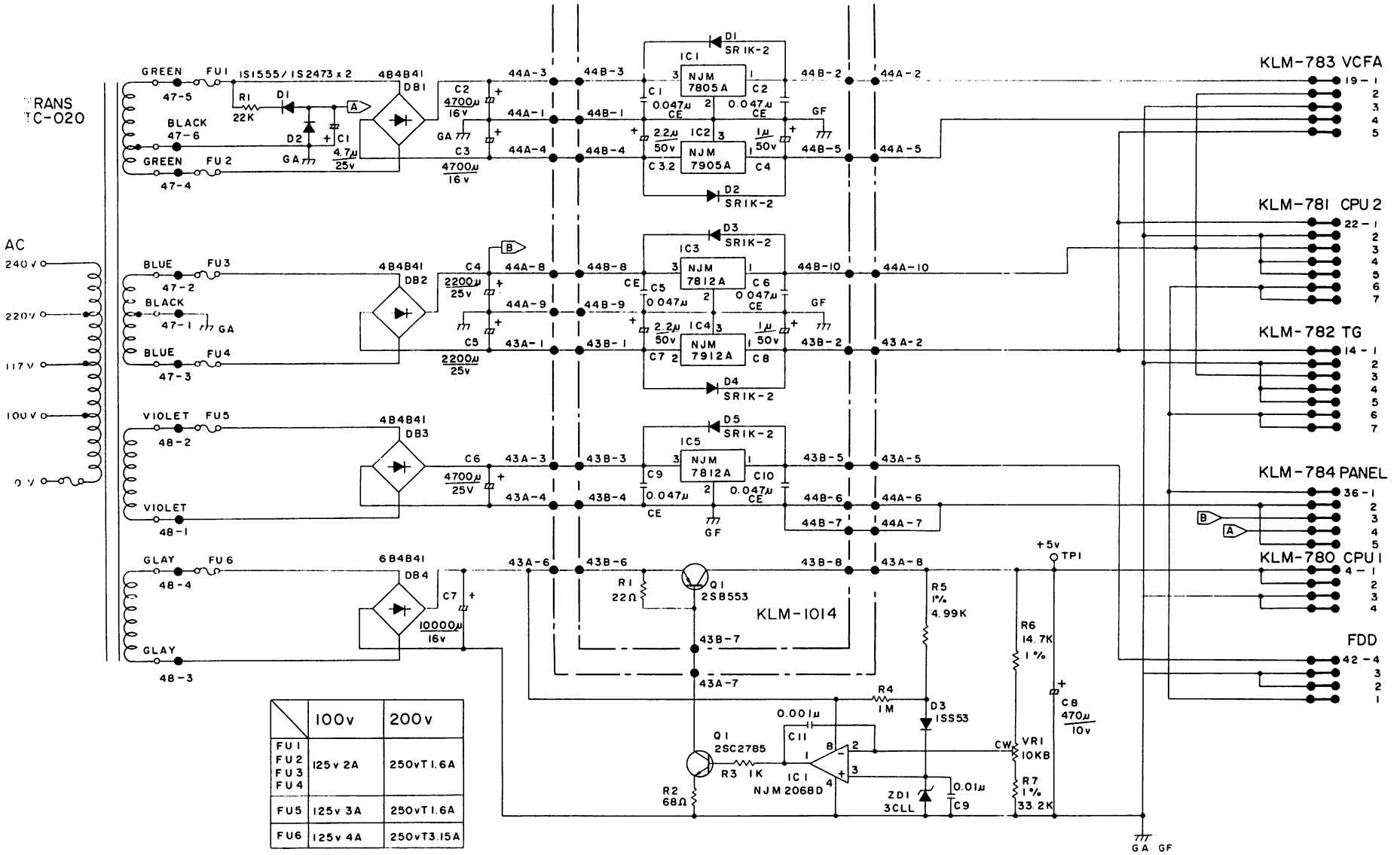
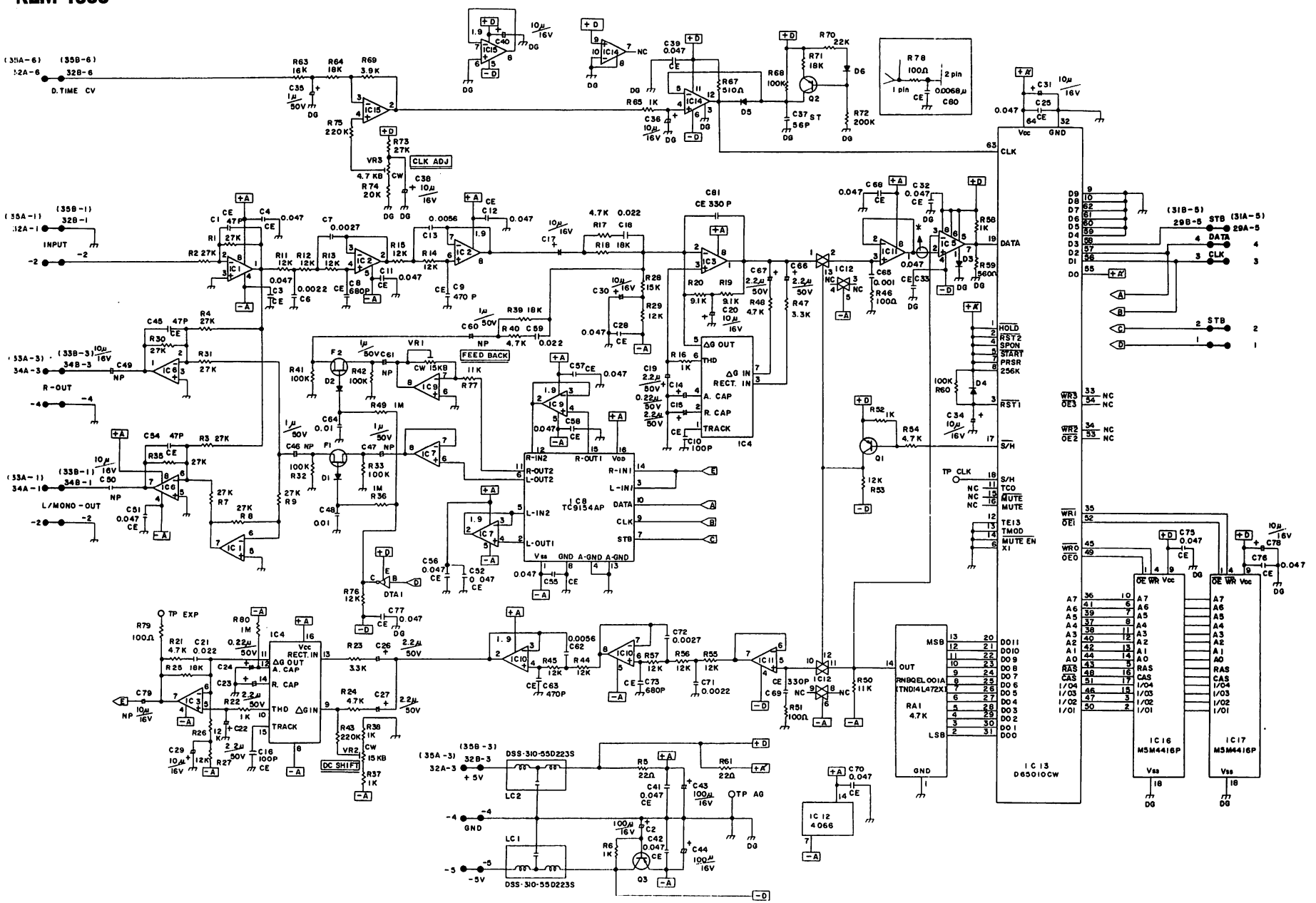


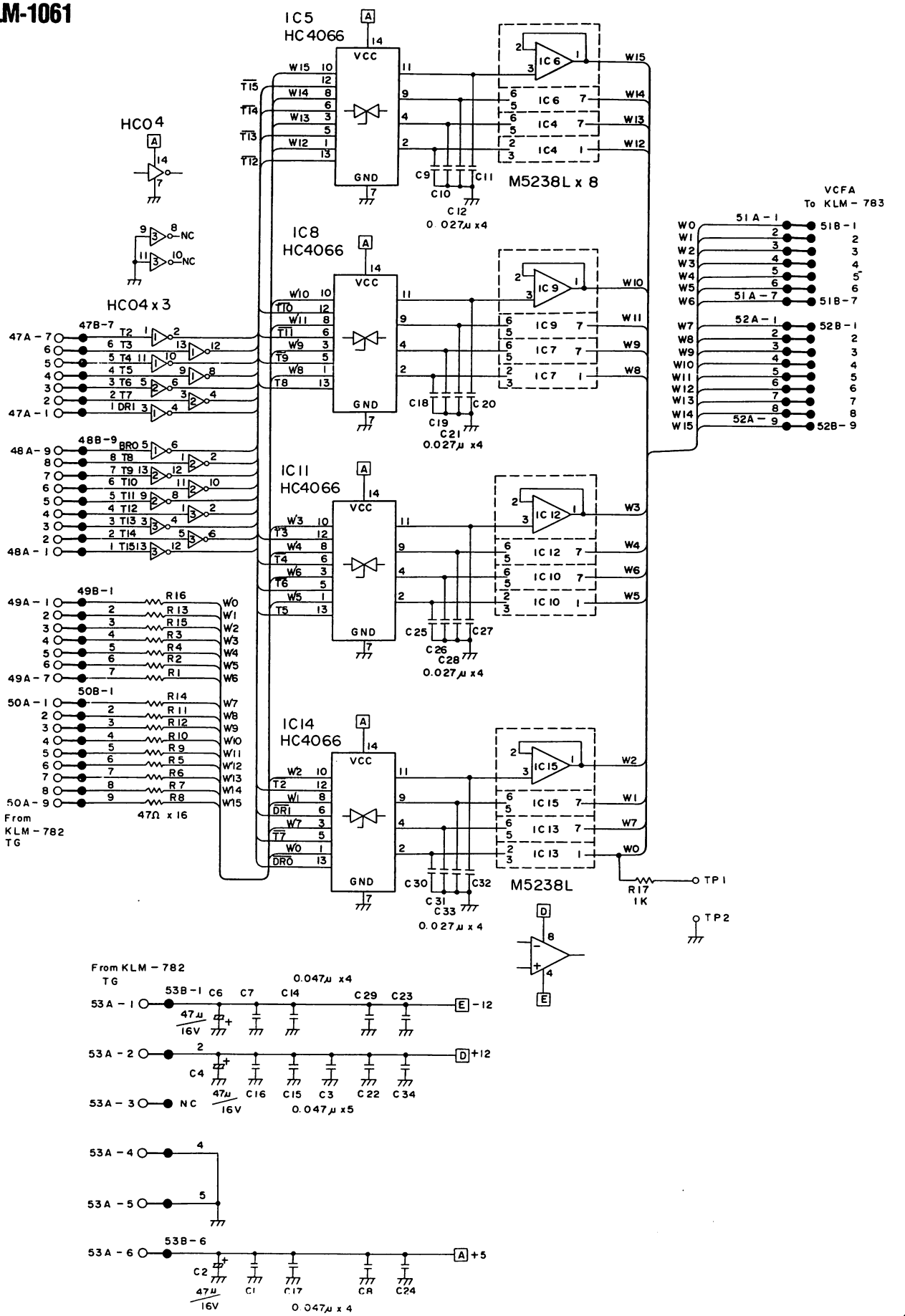
KLM-786



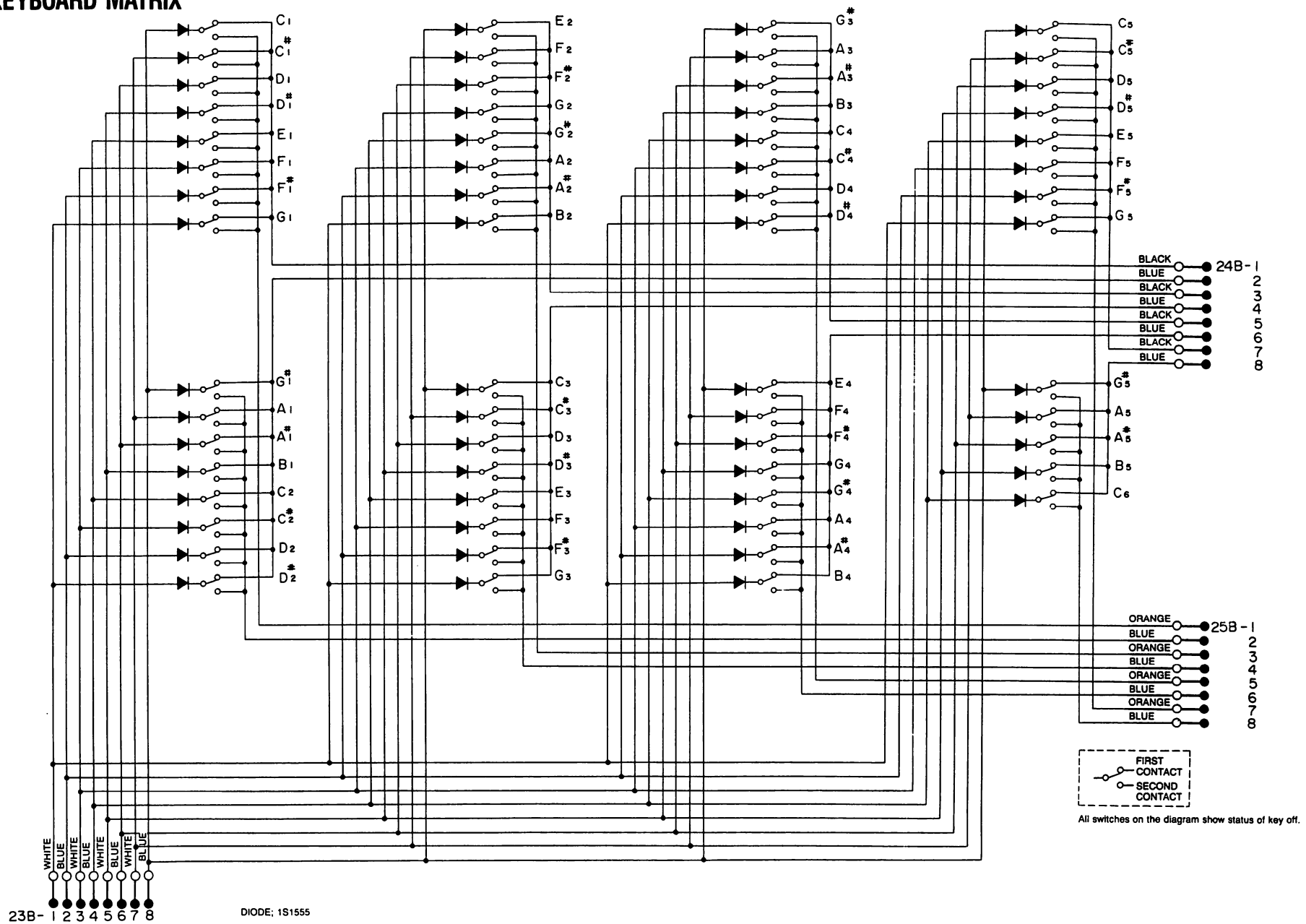
	100v	200v
FU1 FU2 FU3 FU4	125v 2A	250vT1.6A
FU5	125v 3A	250vT1.6A
FU6	125v 4A	250vT3.15A



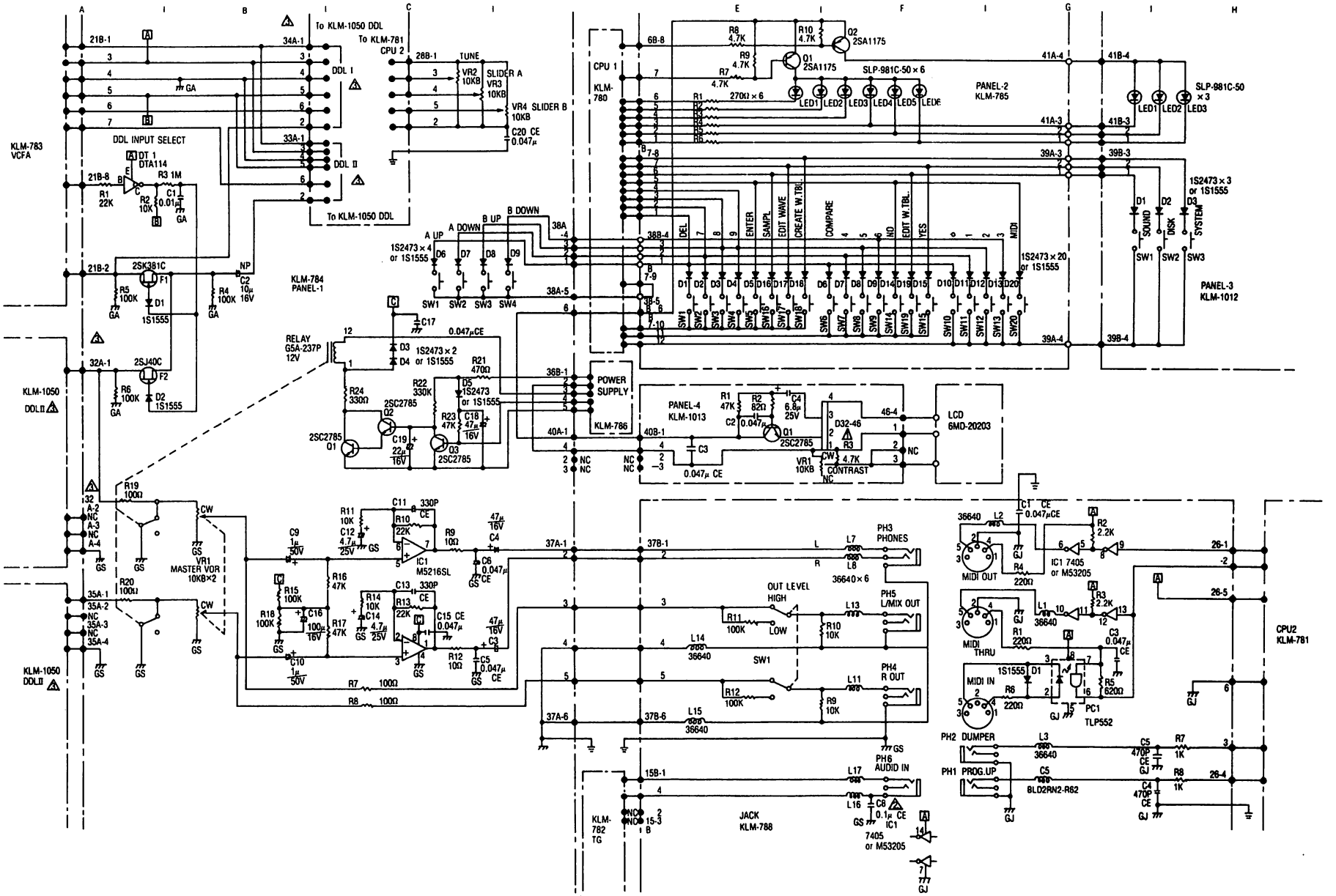
KLM-1061



KEYBOARD MATRIX



KLM-784. 785. 788. 1012. 1013



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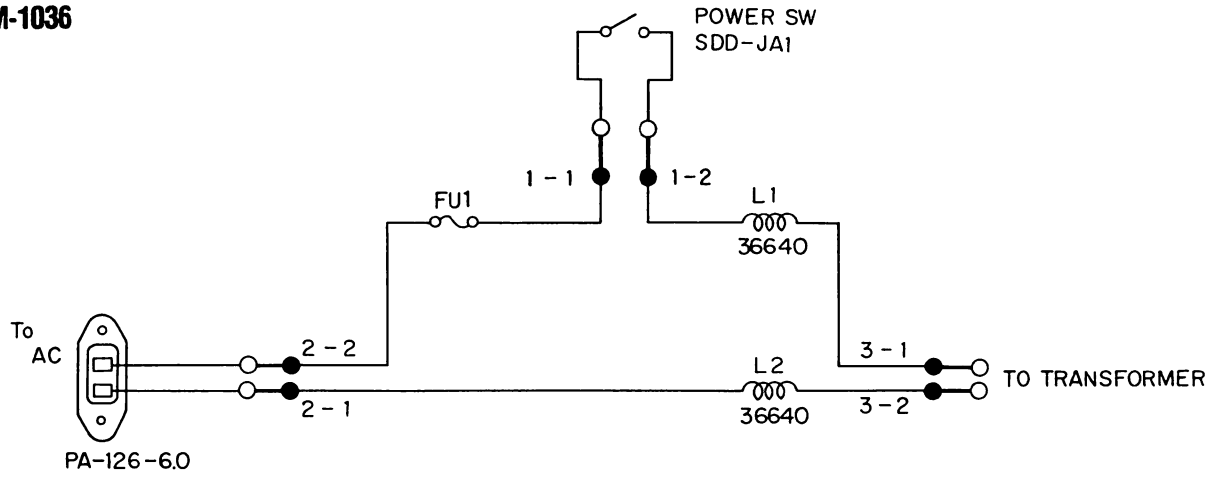

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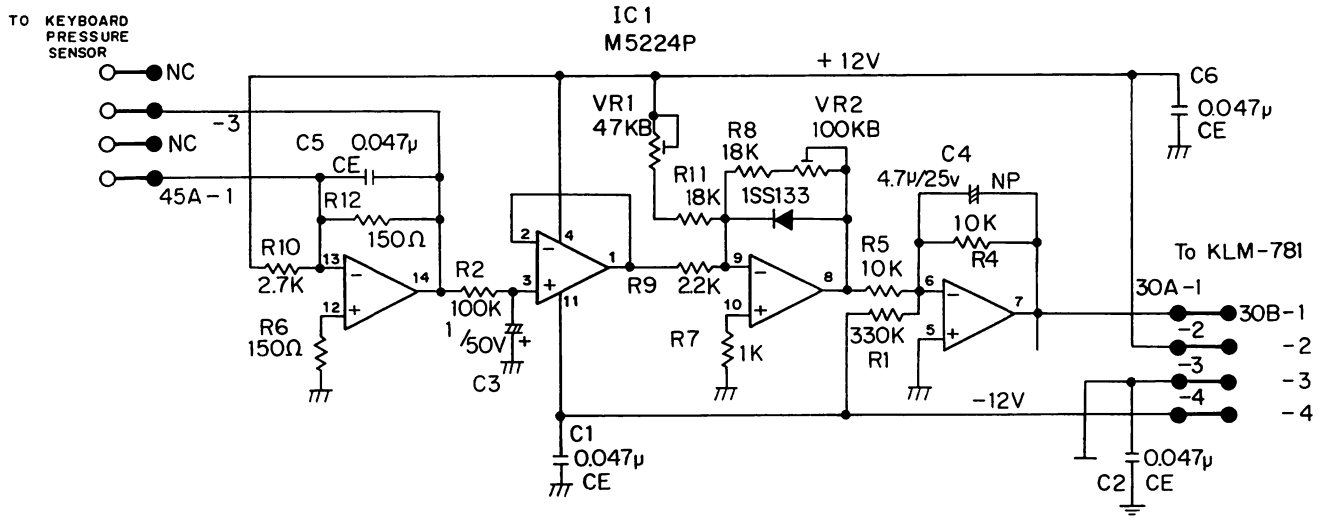
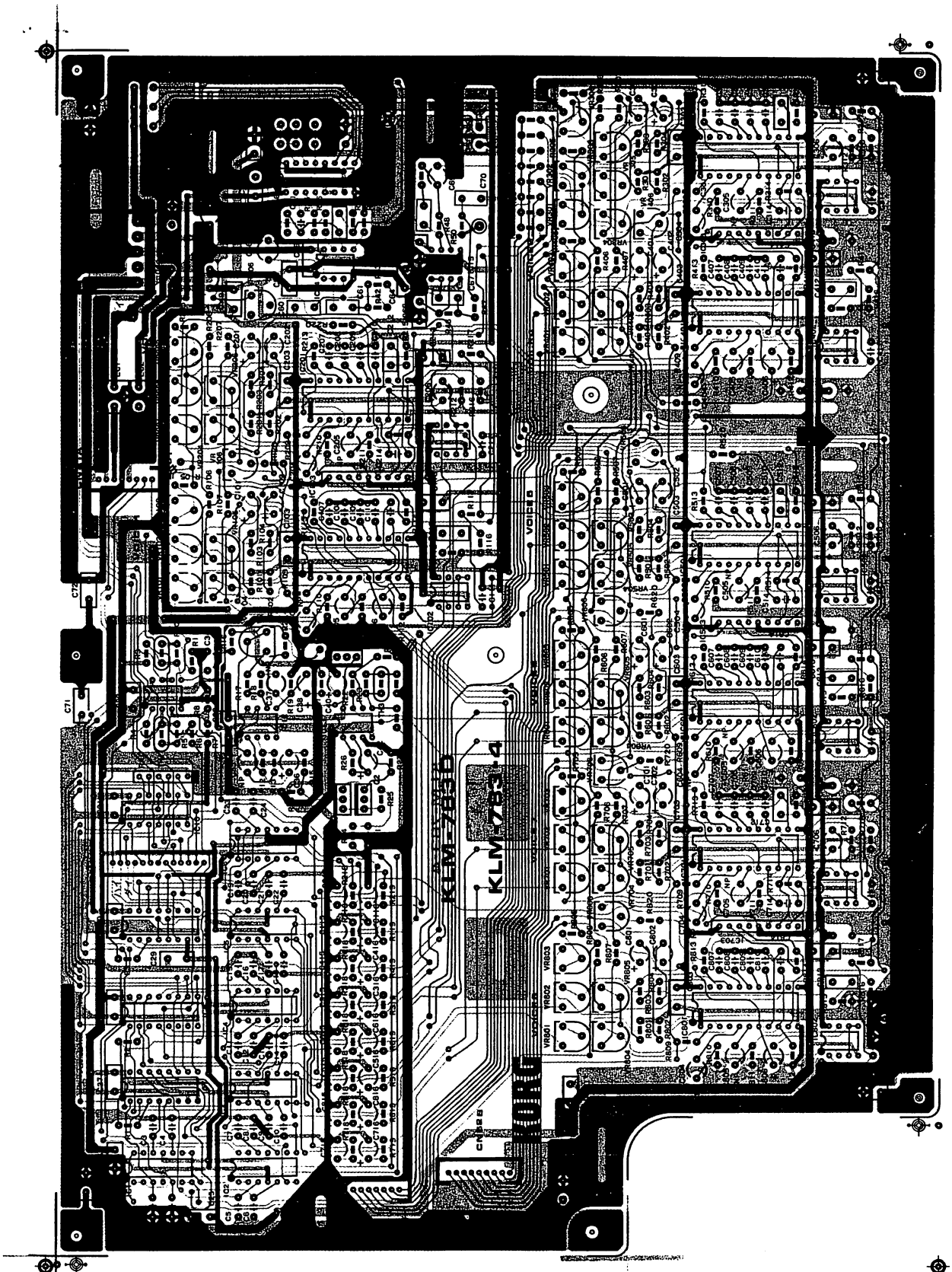
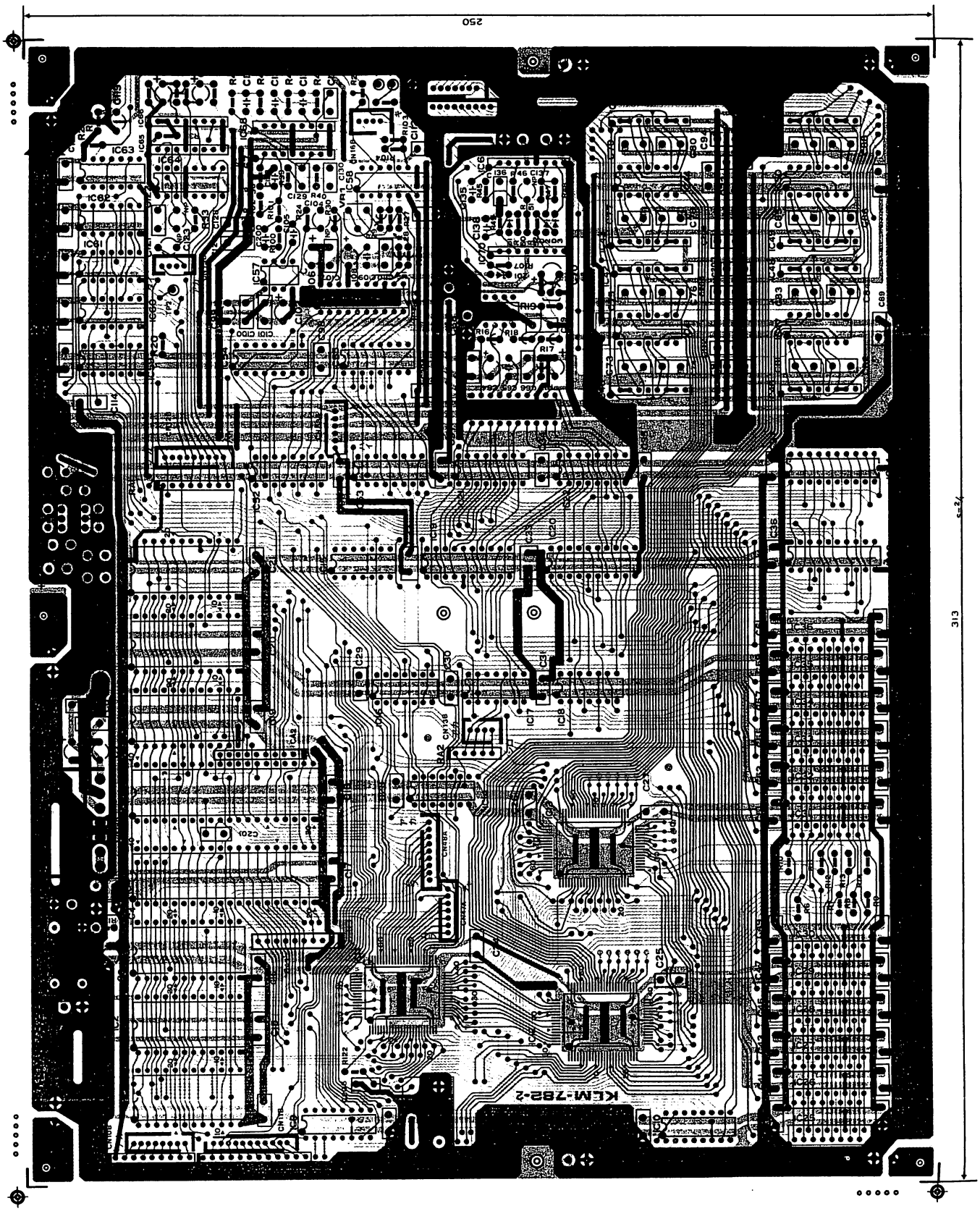


8. P.C. BOARD

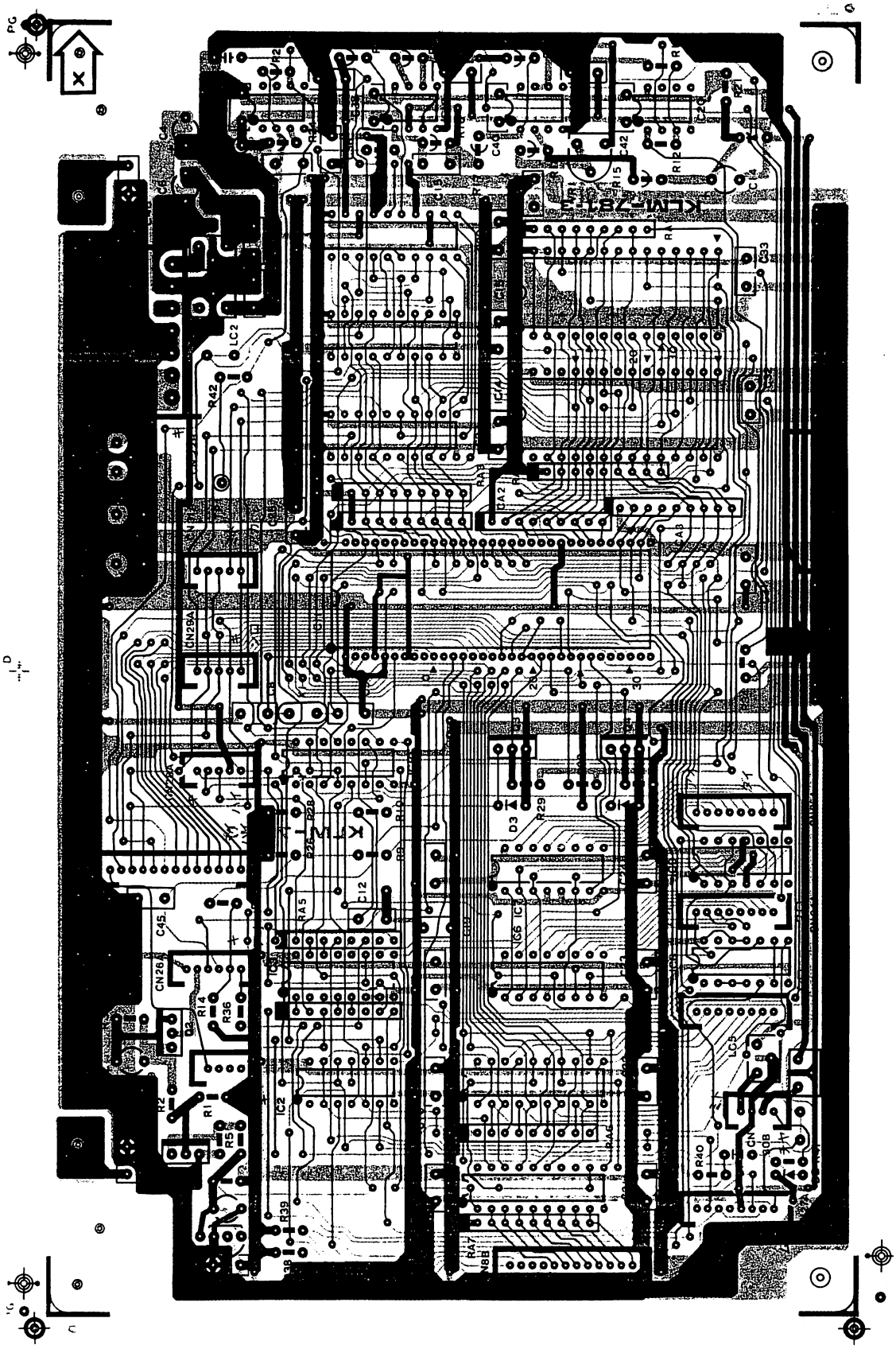
KLM-783



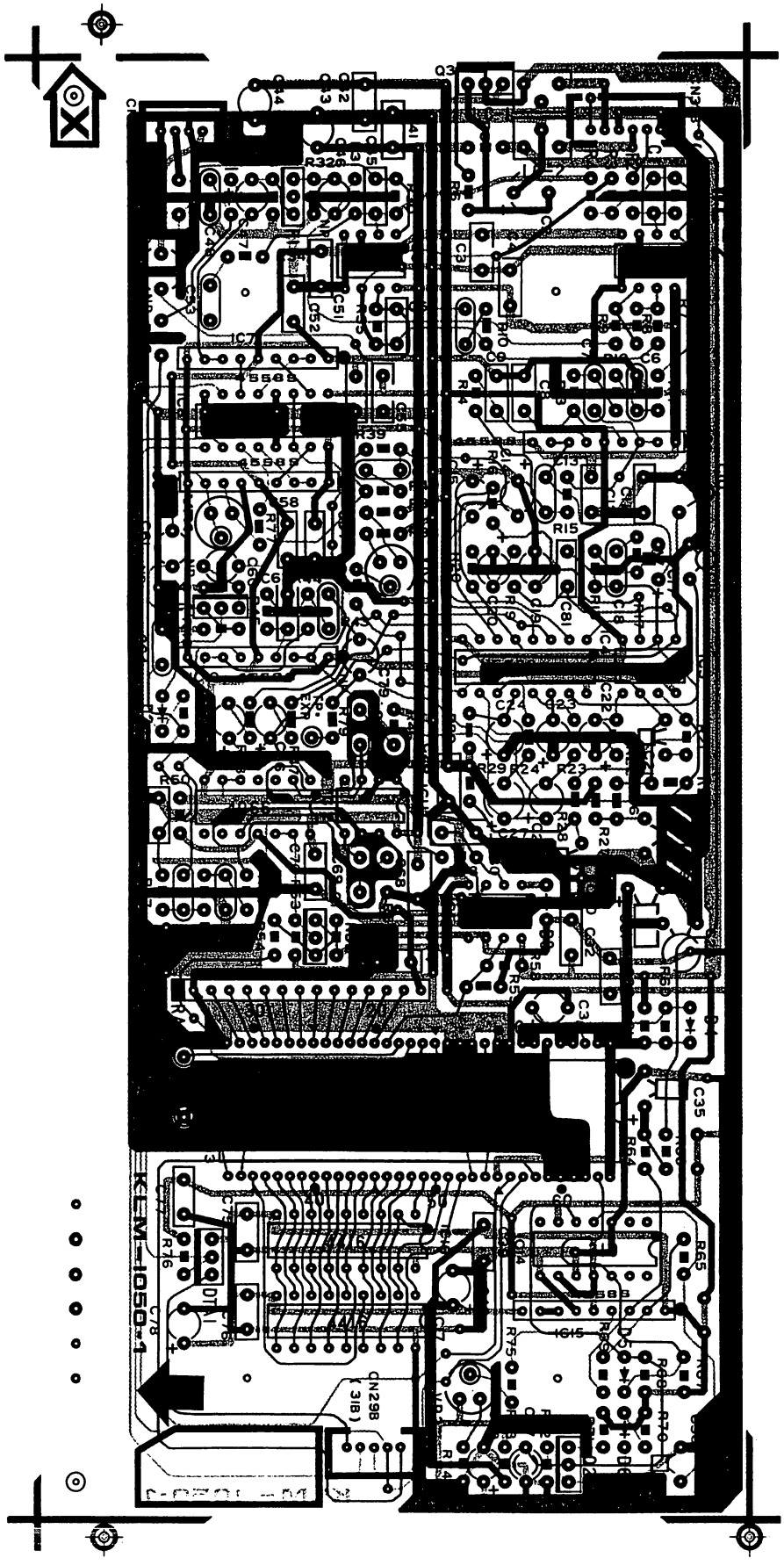
KLM-782



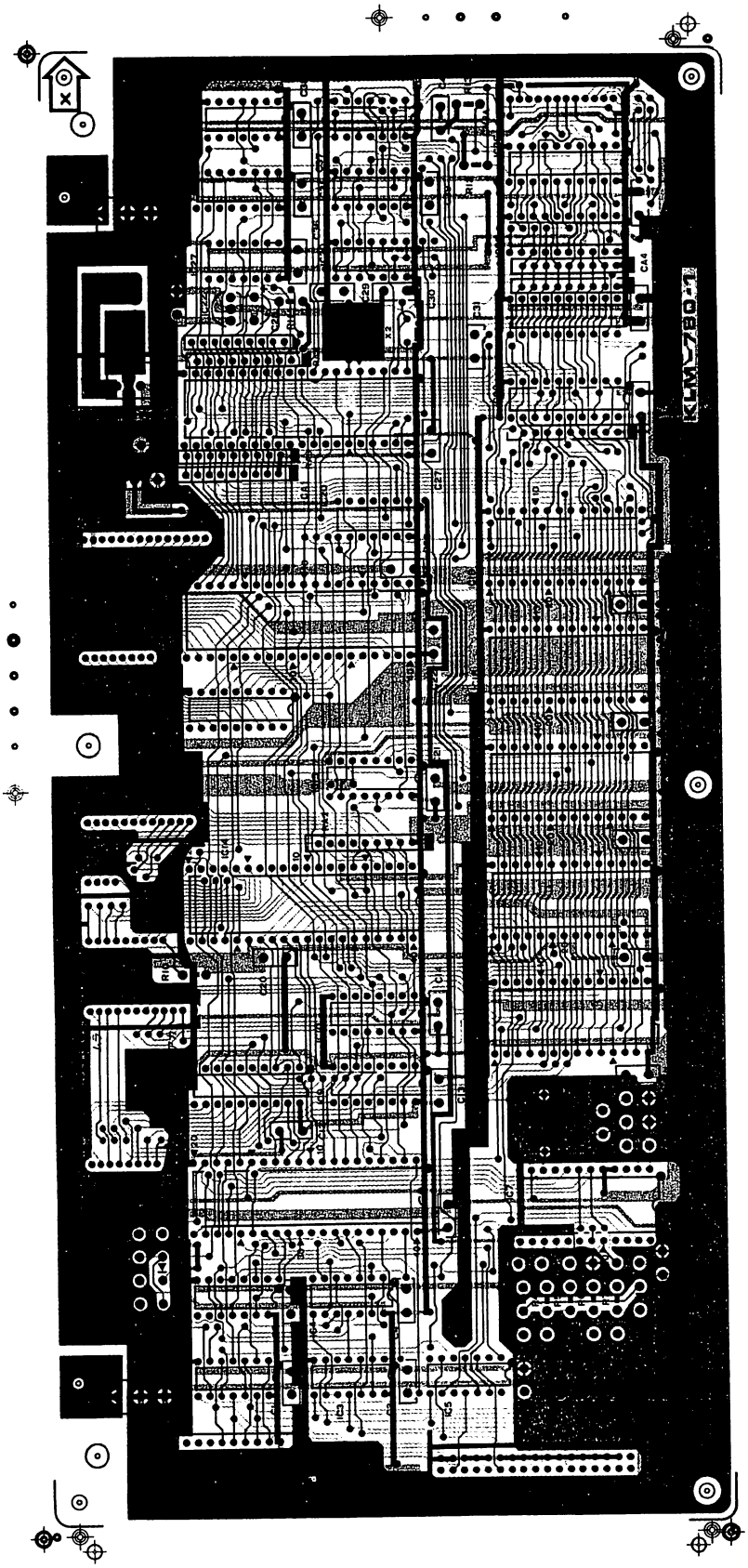
KLM-781



KLM-1050



KLM-780



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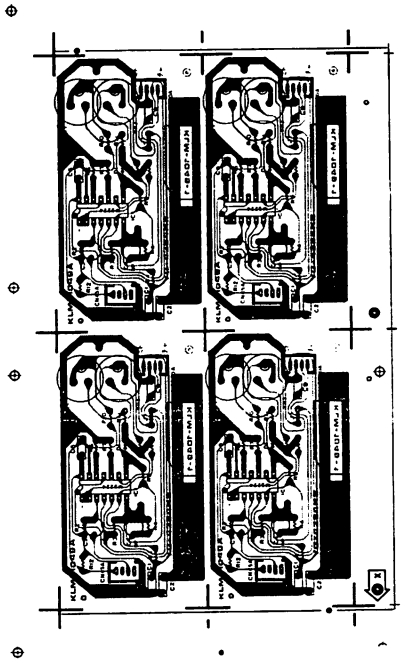
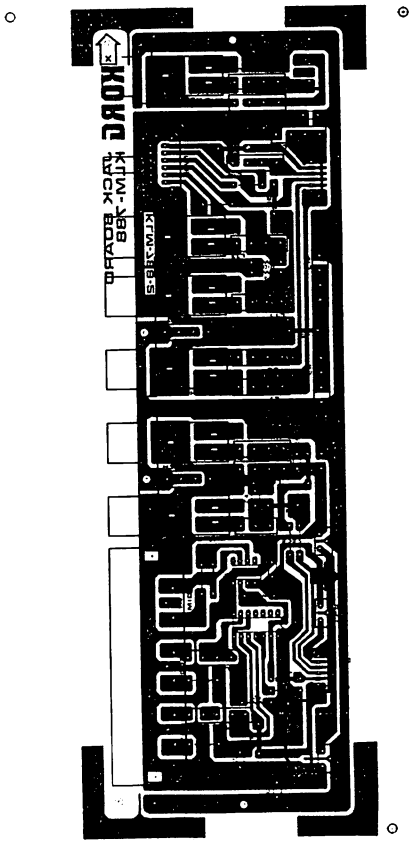


KLM-788



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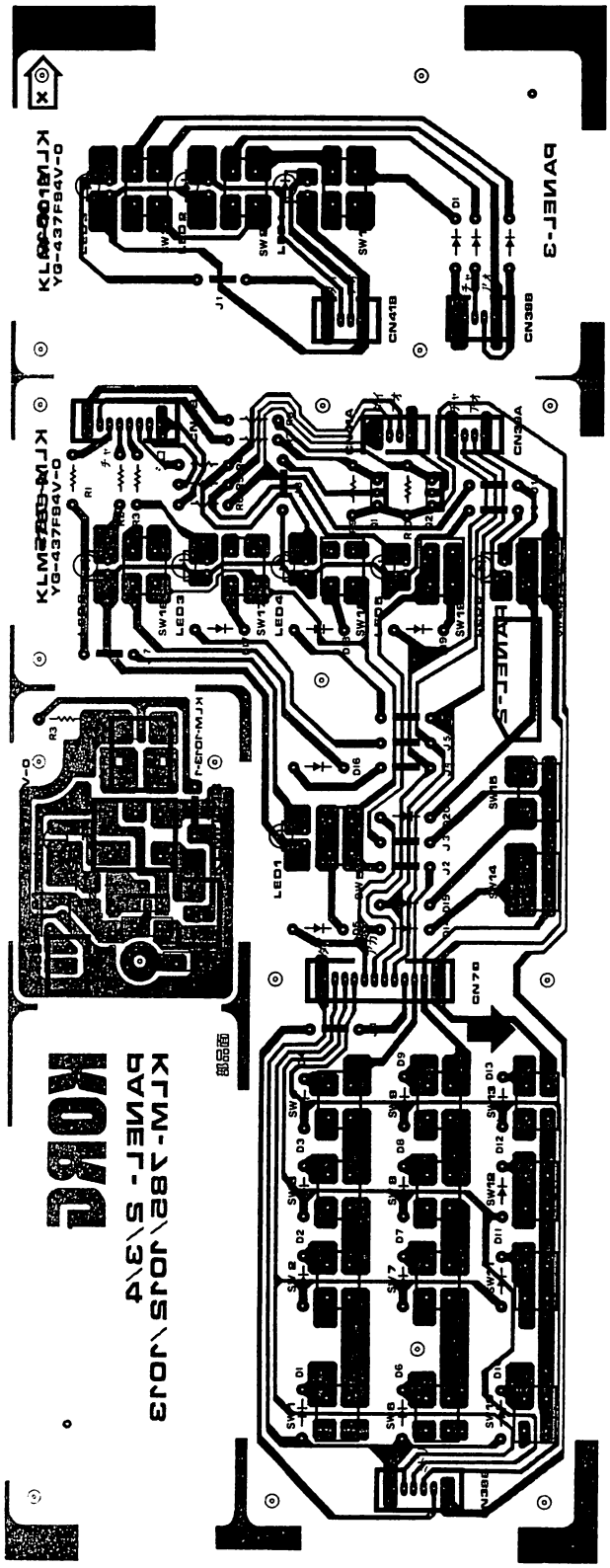

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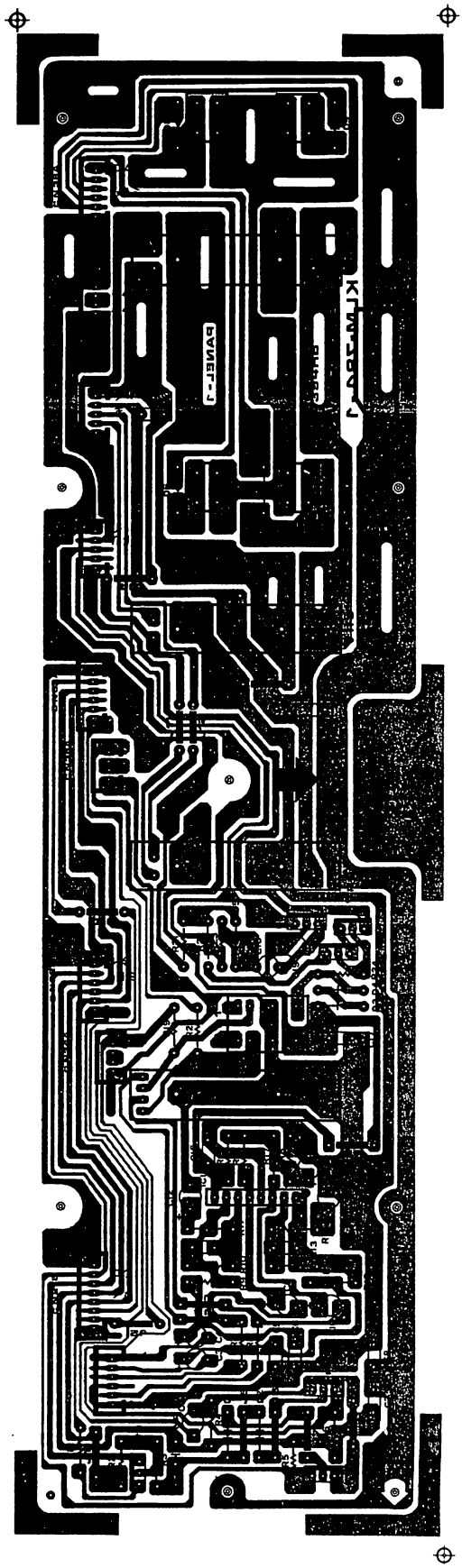
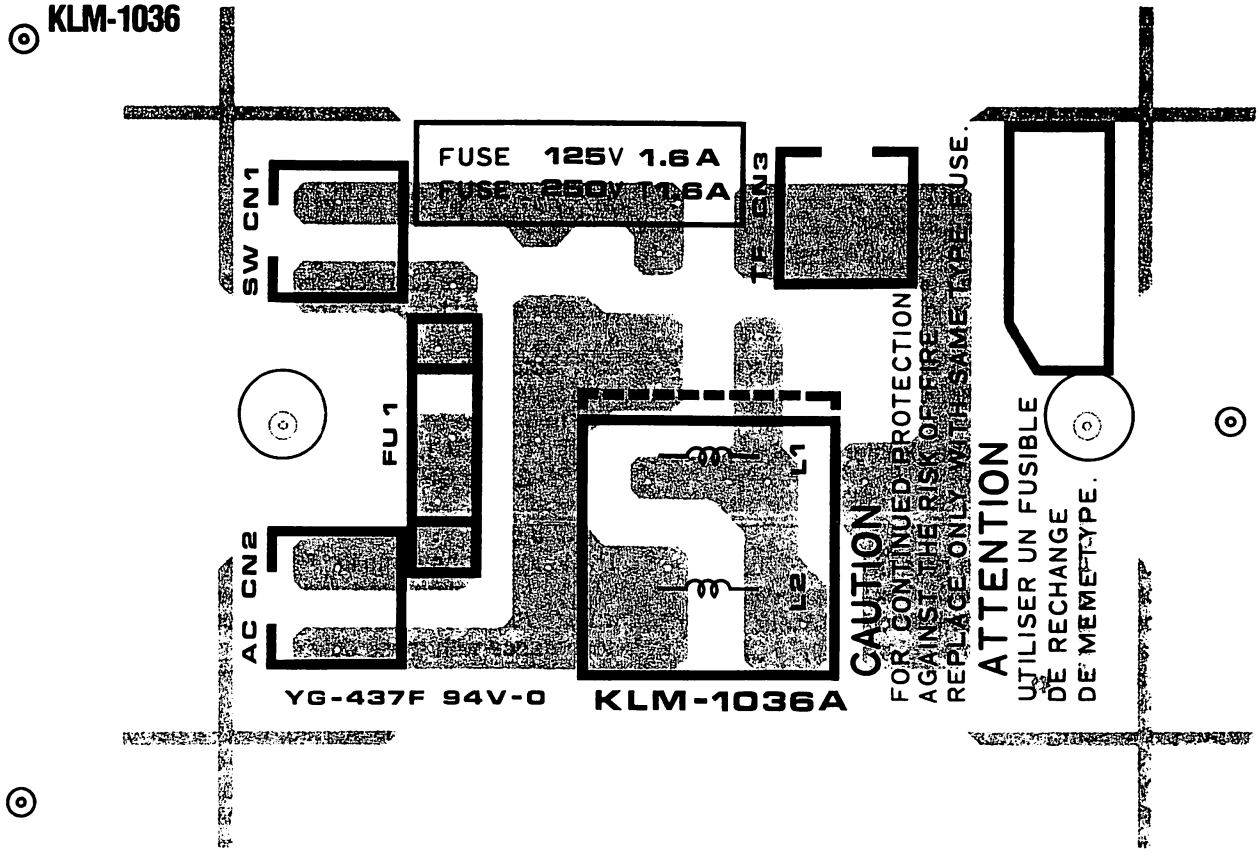
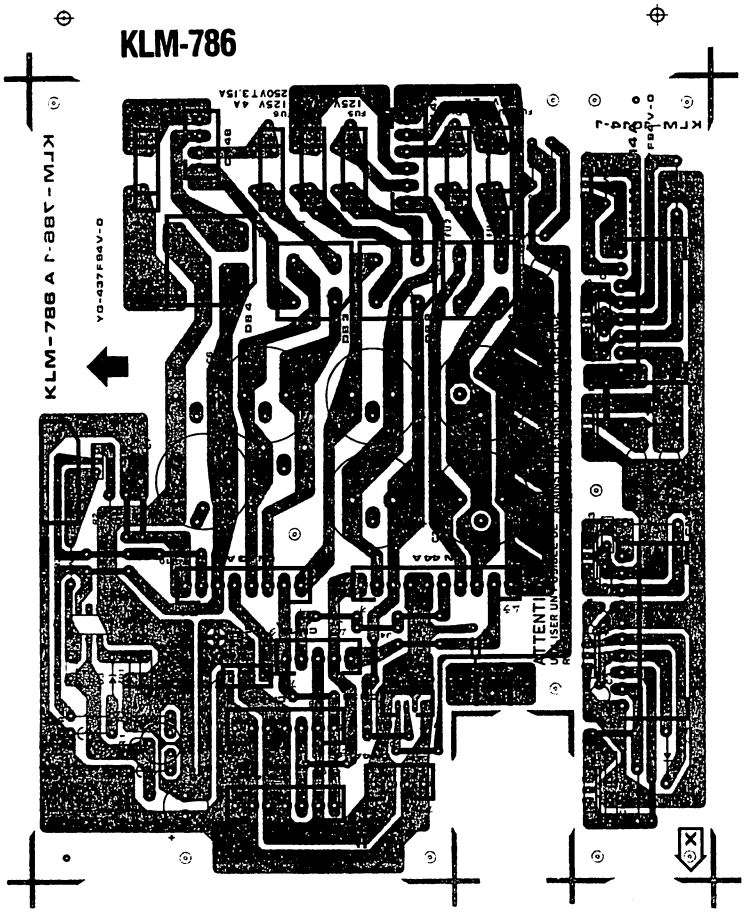


KLM-1036



KLM-786



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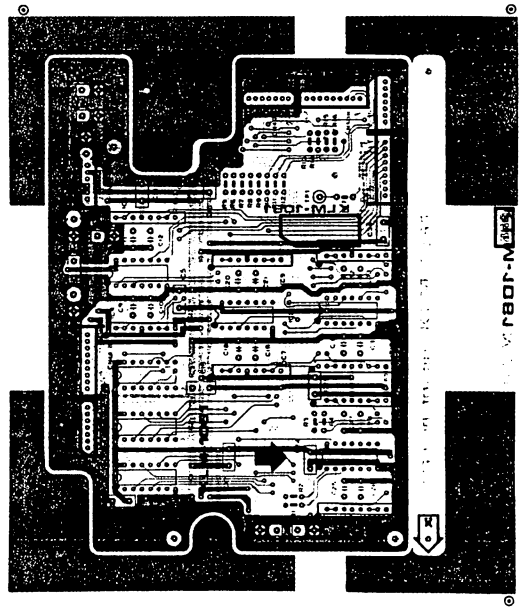


9. SYSTEM EXPLANATION

1. CPU SYSTEM

The DSS-1 digital sampling synthesizer has 8 voices (16 oscillators), all functions are controlled by software.
A dual CPU system is employed. The division of labor between the CPU is as follows.

● CPU 1 (8085A-2, KLM-780)	● CPU 2 (63B03X, KLM-781)
1. LCD and LED indicators	1. KEY scan, KEY assign
2. Panel switch input processing	2. MIDI processing
3. FDD control	3. VCF/VCA control
4. Tone generator processing	4. DDL control
5. Interface with CPU 2	5. Foot switch input processing
	6. Interface with CPU 1

The followings are examples of the division of labor in specific operations.

■ **Sound data processing**
Sound data such as waveform data and VCFA data are all stored on a floppy disk (FD). CPU 1 supervises this storage operation. In addition, waveform data are transferred to a DRAM under the supervision of CPU 1. VCFA data are transferred to CPU 2.

■ **KEY input processing**
CPU 2 does KEY scanning and KEY assigning. Whenever KEY goes ON or OFF, CPU 2 performs VCFA ON/OFF processing, and, at the same time, output to MIDI is performed. Data are also transferred to CPU 1, and CPU 1 performs TG ON processing.

■ **PITCH BEND, MASTER TUNE processing**
CPU 2 performs A/D conversion of CV from the bender and TUNE VR. If there is a change, the changed values are transferred to CPU 1, CPU 1 accesses TG and the musical interval is changed accordingly.

■ **Panel switch input processing; LCD And LED indications**
CPU 1 performs a switch scan and gives the necessary LCD and LED indications.

■ **DATA ENTRY A, B potentiometer value inputs**
CPU 2 performs A/D conversion of CV and then changes values as necessary. The changed values are transferred to CPU 1 and then processed by CPU 1.
If a cutoff is edited in PROGRAM/PARAMETER mode, when DATA ENTRY B is moved CPU 2 transfers that value to CPU 1 and the processing is performed by CPU 1. Then the value is transferred back to CPU 2, and CPU 2 changes the VCF CUTOFF CV.

■ **Sampling**
The length of the sampling frequency is controlled by CPU 1. Sampling start trigger level data are then transferred to CPU 2, and CPU 2 controls the CV in accordance with those data.

■ **Hand drawing**
After hand drawing is started, CPU 2 performs A/D conversion of DATA ENTRY A data every 16 ms. The resulting values are transferred to CPU 1. CPU 1 stores those values in the RAM. When 512 values have been transferred, the operation terminates. CPU 1 produces 8 waveforms (for 8 octaves) from those data and transfers them to the DRAM.

■ **Sine synthesis**
CPU 1 performs the synthesis based on the sine table in the EPROM, produces 8 waveforms (for 8 octaves) and transfers them to the DRAM.

2. Explanation of custom LSI

In the DSS-1, since it is necessary to transfer a large quantity of data at high speed, the DMA (DIRECT MEMORY ACCESS) system is adopted. In this system, data are transferred directly between I/O and memory without going through the CPU registers. The LSIs developed for this purpose are the custom GATE ARRAY μPD65030G-043 (GA-I) and μPD65040G-099 (GA-II). The GA-I receives DMA requests on 16 channels (maximum of 24 channels), encodes them and generates timing. The GA-II stores 8 channels worth of memory addresses, increments addresses in response to requests and outputs in accordance with the GA-I timing.
In the DSS-1, two GA-IIs are needed for each GA-I to cover 16 channels.

■ **Caution**
Both the GA-I and GA-II use 80-pin flat packages. Use caution in repair and replacement.

3. FDD (FLOPPY DISK DRIVE)

A FDD (MD350) is used to READ/WRITE sound parameter data on an FD (3.5-inch FLOPPY DISK).
The basic mechanical movement in the FDD is that when the DISK rotates the HEAD moves in the radial direction. It is made up of a great many mechanical parts.

Special jigs developed by the manufacturer are needed for repair and adjustment, so repair by anyone other than the manufacturer is impossible. Consequently, complete units must be replaced.
Judge whether an FDD is malfunctioning by swapping FDDs.

4. CPU 1 MEMORY MAP

0000H	EP-ROM 27256 (BANK 0) (KLM-780 IC19)	EP-ROM 27256 (BANK 1) (KLM-780 IC18)
8000H	EP-ROM 2764 (KLM-780 IC12)	BANK 0 AND BANK 1 OF 27256 IS SWITCHED EACH OTHER BY HC74 ADDRESSED AT C800H.
A000H	RAM 4364 (KLM-780 IC11)	
C000H	8155-2 (KLM-780 IC17)	
C400H	8255-2 (KLM-780 IC14)	
C800H	BANK SWITCH PORT HC74 (KLM-780 IC30)	
D000H	82C53 (1) (KLM-782 IC1)	
D004H	82C53 (2) (KLM-782 IC2)	
D008H	82C53 (3) (KLM-782 IC3)	
D00CH	82C53 (4) (KLM-782 IC6)	
D010H	82C53 (5) (KLM-782 IC7)	
D014H	82C53 (6) (KLM-782 IC8)	
D018H	DMA RAM LOW BYTE WRITE PORT HC374 (KLM-782 IC23)	
D01CH	DMA RAM HIGH BYTE WRITE PORT HC374 (KLM-782 IC23)	

D020H	GATE ARRAY III (1) (KLM-782 IC4)
D040H	GATE ARRAY III (2) (KLM-782 IC5)
D060H	GATE ARRAY I (KLM-782 IC11)
D080H	GATE ARRAY II (1) (KLM-782 IC13)
D0A0H	GATE ARRAY II (2) (KLM-782 IC12)
D0C0H	DMA RAM LOW BYTE READ PORT HC374 (KLM-782 IC20)
D0E0H	DMA RAM HIGH BYTE READ PORT HC374 (KLM-782 IC19)
D400H	CPU I→CPU II PORT HC374 (KLM-780 IC25)
D800H	CPU II→CPU I PORT HC374 (KLM-780 IC26)
DC00H	FDC μPD765A (KLM-780 IC6)
E000H	RAM 4364 (KLM-780 IC13)
FFFFH	

■CPU1 PROGRAM ROM MAP

27256 BANK 0		
0000	CPU I/F	CPUiF
0520 ~ 0570	TG JUMP TABLE DMA ADDRESS SET	TGJUMP
05D0	HARMONICS TABLES	HTBL
0680 ~ 7FFF	EDITOR MAIN & SUB	MAIN

2764		
8000	BANK CHANGE ROUTINES	BNKSW
8053	VERSION No. DISPLAY	ver
8070 ~ 9FFF	EDITOR UTILITIES	EDUTL

27256 BANK 1		
0000	CPU I/F	CPUiF
0520	TG	TG
1920	DOS + FDD UTILITY	FDOS
3890	MIDI EX	EX
45B5	NOT USED (4BH)	
4600	TEST MODE	TESTMODE
48E0 ~ 7FFF	EDITOR SUB (SUB1+SUB2+SUB3+SUB4)	SUB

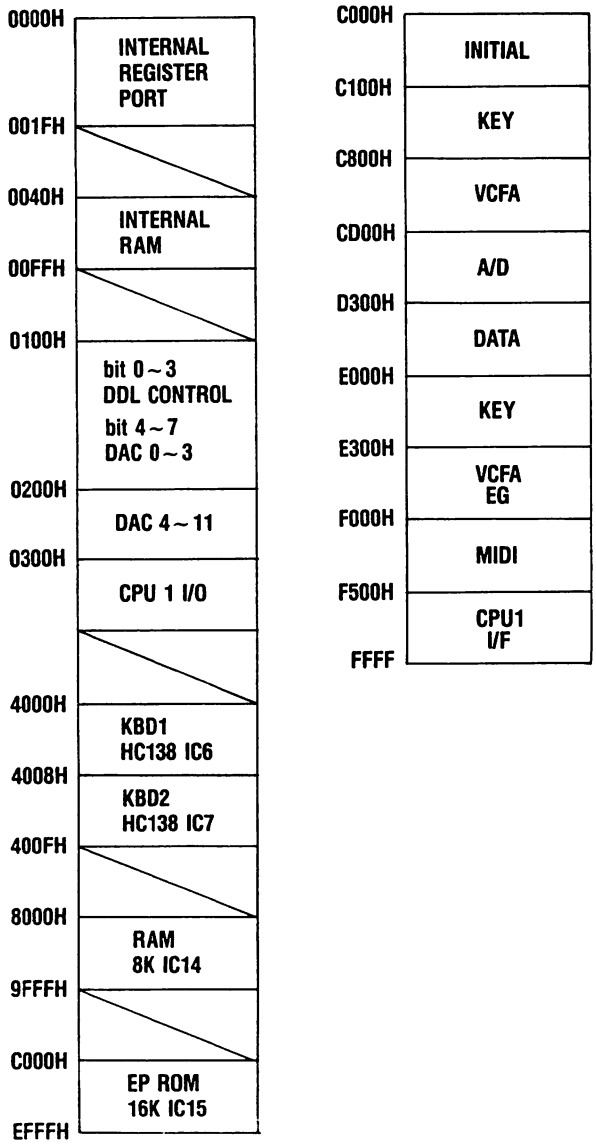
■DSS-1 SOFTWARE DOCUMENT

CPU-1 MEMORY MAP AND COMMON USE WORKING AREA

■RAM MEMORY MAP

ADDRESS	CONTENTS
A000H - A1FFH	TG Controller Work Area
A200H - A74FH	FDOS Work Area
A750H - A76FH	FD Utility Work Area
A770H - A7EFH	CPU-1 Initial Work Area
	CPU-1←→CPU-2 Interface Work Area
A7F0H - A7FFH	FDD Test Work Area
A800H - A90FH	FDOS Work Area
A910H - 839FH	Program Parameter
B3A0H - BBFFH	Common Use Work Area
BC00H - C0FFH	Editor Work Area (1)
E000H - F5CFH	Multi Sound Parameter
F5D0H - F60FH	MIDI Exclusive Receive Work Area
F610H - F6EFH	Editor Work Area (2)
F6F0H - FAEFH	FDD Data Buffer
FAF0H - FCEFH	Editor Work Area (3)
FCF0H - FFEFH	Stack Area
FFF0H - FFFFH	Spare

■CPU2 ROM MAP



■ VCF VCA EF SELECT

	bit 7	6	5	2	1	0	
PORT 2 0003H	0	0	0	—	—	—	VCF FC 1~8
	0	1	1	—	—	—	VCA 1~8
	1	0	1	0	0	0	DDL1 MOD CV
	1	0	1	0	0	1	DDL2 MOD CV
	1	0	1	0	1	0	NOP
	1	0	1	0	1	1	SAMPL START TRG CV
	1	0	1	1	0	0	NOISE
	1	0	1	1	0	1	RESONANCE
	1	0	1	1	1	0	LEVEL 2
	1	0	1	1	1	1	LEVEL 1

■ AD SELECT etc.

	bit 7	6	5	4	3	2	1	0	
PORT 6 0017H						•	•	•	AD SELECT
						0	0	0	BENDER
						0	0	1	MG
						0	1	0	TUNE
						0	1	1	DATA ENTRY A
						1	0	0	DATA ENTRY B
						1	0	1	NOP
						1	1	0	AFTER TOUCH
						1	1	1	INPUT SIG LEVEL
					•				VCF MODE (24db/12db)
				•					SERIAL CLK
			•						SERIAL DATA
		•							SERIAL EQ STB
	•								SERIAL DDL 1
									SERIAL LEVEL STB

■ DAC bit 0~etc.

	bit 7	6	5	4	3	2	1	0	
0100H								•	DDL MUTE
							•		DEL1 TIME STB
						•			DDL2 LEVEL STB
					•				DDL2 TIME STB
	•	•	•	•					DAC bit 0~3

5. TEST program Explanation

■OUTLINE OF DSS-1 INTERNAL INSPECTION MODE

The inspection program given below is stored in the DSS-1 system ROM. When the power switch is switched from OFF to ON while pressing both the DATA ENTRY A section UP and DOWN keys (▲ ▼) simultaneously, the TEST MODE is activated. In this mode, the system runs in the following sequence, and inspection is carried out.

Software: version indication and date indication
FDD function test
W•RAM test
Panel switch confirmation

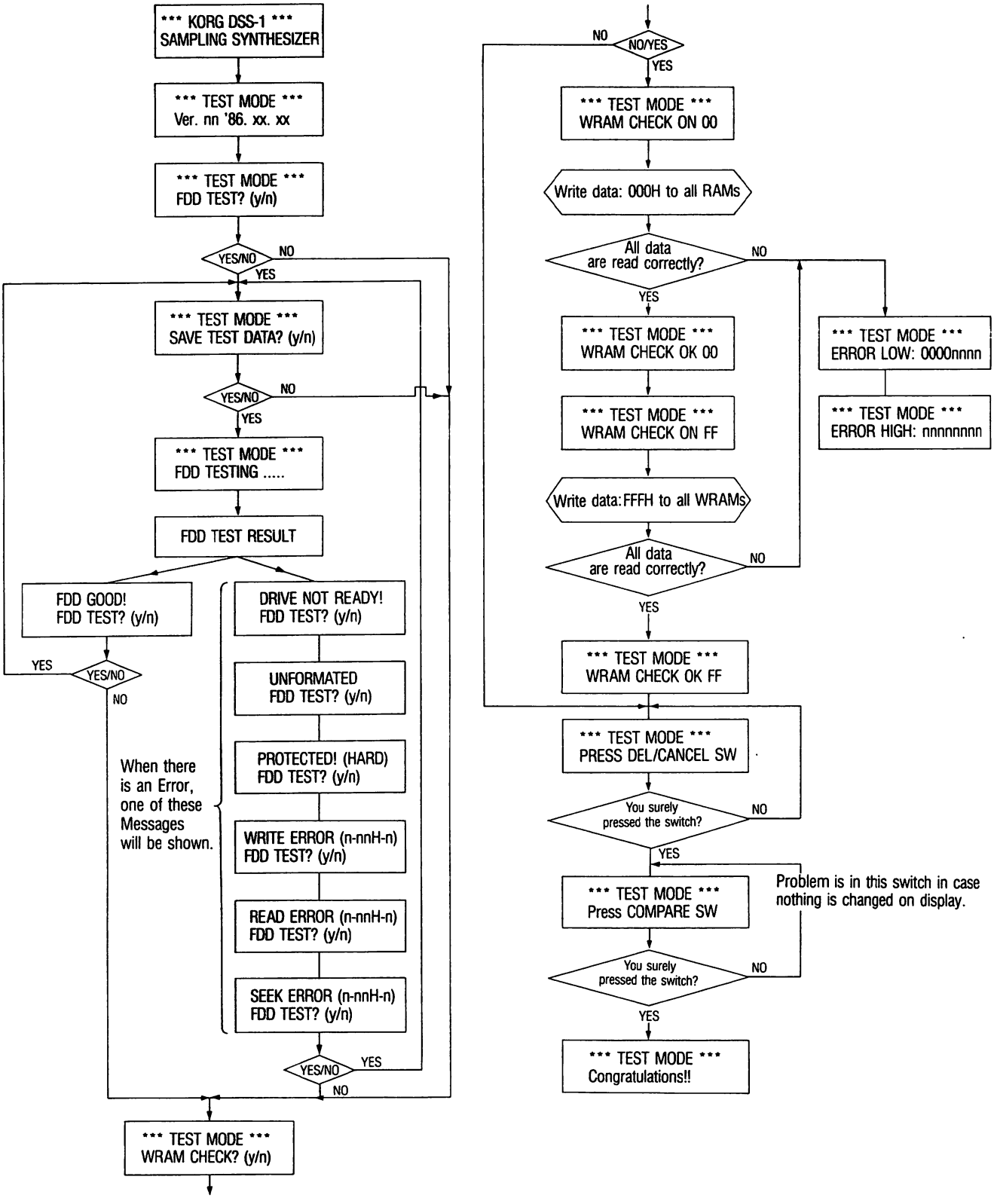
It is convenient for one FD to be set aside to be used exclusively for FDD tests.
(Caution) For FDD tests, use one that has already been formatted. Also, when an FDD test is run, all of the data are erased.

Note 1
After entering "SYSTEM MODE", everything is in normal status except for the following conditions:
MASTER TUNE, PITCH BENDER, AUTO BEND, and PITCH MODULATION are ineffective.
VOICE NO. data are output to MIDI-OUT.
VOICE NO. is indicated on LCD in PLAY MODE.

Note 2, MIDI
MIDI is "90", "3C" and "40" note-on data signals. Every time the voice changes from 1 to 8, conversion to the following data is performed (the lower 4 digits of the status change).

1 VOICE	90, 3C, 40
2 VOICE	91, 3C, 40
3 VOICE	92, 3C, 40
4 VOICE	93, 3C, 40
5 VOICE	94, 3C, 40
6 VOICE	95, 3C, 40
7 VOICE	96, 3C, 40
8 VOICE	97. 3C, 40

■TEST PROGRAM CHART



■TEST MODE EXPLANATION

1. Turn power ON (of course while simultaneously pressing section A data entry switches ▲ ▼) and select the DSS-1 internal inspection mode.

> **Note:**
> If this indication appears, you can assume that CPU 1 and the LCD are operating normally.

2. One to two seconds later an indication that the test mode has been entered appears. The internal ROM version No. and the creation data are indicated simultaneously.

> **Note:**
> If there are problems on the TG circuit board, the system does not proceed to the TEST MODE indication.

3. Use the cursor (Y/N) to select whether or not the floppy disk drive is to be inspected. If NO, proceed to step 12.

4. Cursor (Y/N) key judgment

5. Insert a previously formatted medium and ask the system whether it is all right to write in (save) test data for that medium. This is also selected by the cursor (Y/N).

6. Cursor (Y/N) key judgement

7. Save test data for the medium (while writing in).

9. Errors: "refer to S-1"

10. From the results of reading and writing the test data for the medium, an indication that the FDD is normal is given. Asks whether it is necessary to try one more time.

11. Cursor (Y/N) key judgment

12. Asks whether to perform a TG (KLM-782) WAVE RAM check.

13. Cursor (Y/N) key judgment

14. The data 0000 0000 0000B are written in to the 12-bit WAVE RAM on the TG circuit board 1 bit at a time; if the writing can be done until the last address, the fact that they are 0000 0000 0000B is read in.

18. The data 1111 1111 1111B are written in to the 12-bit WAVE RAM on the TG circuit board 1 bit at a time; if the writing is completed to the last address, then the fact that they are 1111 1111 1111B is read in.

21. Each write/read operation is performed, and the fact that the WAVE RAM is normal is indicated.

22. Check whether or not the "DEL/CANCEL" works. If it doesn't work when pressed (system does not proceed to the next step) then the switch is bad.

24. Similarly, check whether the "COMPARE" switch works.

26. The checks in the internal inspection mode shall be passed.

27. W•RAM error; refer to "S-2".

■"S-1" FDD ERROR MESSAGES

9-1	DRIVE NOT READY!	There is no disk in the drive, or it is not in securely.
9-2	UNFORMATED!	The disk is not formatted.
9-3	PROTECTED! (HARD)!	Write protect is in effect. The disk tab is in the write in prevent position.
9-4	WRITE ERROR (□—□□H-□)!	A write-in error has occurred in the (□-□□H-□) section.
9-5	READ ERROR (□—□□H-□)!	A read-in error has occurred in the (□-□□H-□) section.
9-6	SEEK ERROR (□—□□H-□)!	A head movement error has occurred in the (□- □□H-□) section.

Note: (□—□□H-□) = (□—□□H-□)!

- Physical sector number (1 to 5)
- Cylinder address (00 to 4F)
- Head number (0 or 1)

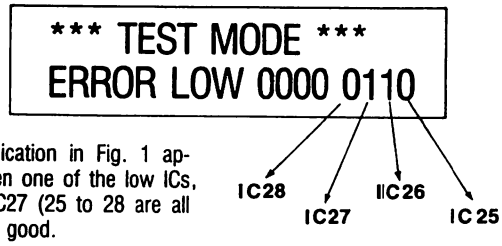
■"S-2" W•RAM DATA ERROR INDICATIONS

★ The IC number is classified as low or high (W•RAM on TG circuit board)

LOW =	HIGH =
IC25	IC29
IC26	IC30
IC27	IC31
IC28	IC32
	IC33
	IC34
	IC35
	IC36

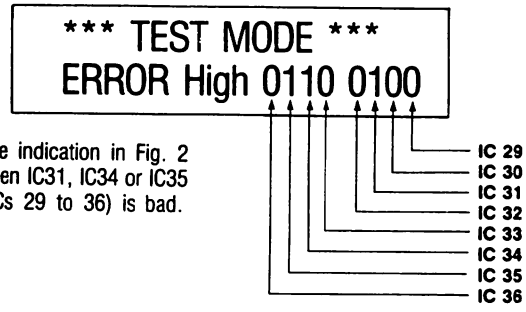
● Assume that 00H (0000 0000 0000B) has been written in the W•RAM, and that one of the bits is no good.

Fig. 1



If the indication in Fig. 1 appears, then one of the low ICs, IC26 or IC27 (25 to 28 are all low) is no good.

Fig. 2

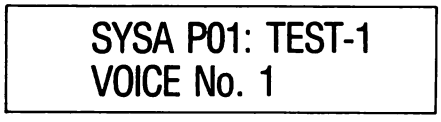


Should the indication in Fig. 2 appear, then IC31, IC34 or IC35 (among ICs 29 to 36) is bad.

■EXPLANATION OF VOICE NO. INDICATIONS

When the system is rising in TEST MODE, the VOICE number is indicated on the LCD in "PLAY MODE".

Example: When the VOICE No. is "1"



The VOICE numbers are 1 to 8. Every time the first gate turns ON, the indication changes.

★ When this function is being used, make sure that system loading is not done by program change by the MIDI.

(Set MIDI PGM CHANGE MODE to "OFF" or "MODE 3".)

If this is not done then the second digit of the LCD indication will go off.

10. MAIN CIRCUIT EXPLANATION

1. KLM-780

The CPU employs an 8085A-2 (IC21) 8-bit microcomputer; the system clock is 10 MHz. The clock output is frequency divided by about 2 to give an output frequency of about 5 MHz and input to the counter timer input terminal of 8155 (IC17). A 1.14 kHz rectangular waveform is output from 8155 TIMER OUT (PIN 6), so that interrupt processing is performed for musical scale data sets for 8 voices, BEND processing, LFO period etc. (Processing is done 9 times per period.)

The EPROM consists of two 32 KB ICs (IC18 and IC19) and one 8 KB IC (IC12). The CPU memory space is a maximum of 64 KB, so the HC74 (IC30) controls changeover between the two 32 KB EPROMs (IC18, IC19).

Two 8 KB RAMs (IC11 and IC13) are used. These are used for program parameter storage and working, and for multisound parameter storage and working.

An 8155 (IC17) and 8255 (IC14) are used for I/O. The functions of the ports are as follows.

■8155

PORT A0 ~ A7	LCD control data input/output port
PORT B0 ~ B7	Panel LED control signal output
PORT C0 ~ C2	LCD control address output
PORT C3 ~ C5	FDC control signal output

■8255

PORT A0 ~ A7	Panel switch DATA INPUT PORT
PORT B0 ~ B3	Panel switch scan OUT PORT
PORT B4 ~ B7	TG WAVEFORM RESOLUTION
PORT C0	Input signal GAIN, ATT control data output
PORT C1	Input signal GAIN, ATT control clock output
PORT C2	Input signal GAIN, strobe output
PORT C3	TG A/D MODE SELECT signal output
PORT C4	PCM DATA TRANSFER MODE output (CPU 1 → DRAM)
PORT C5	PCM DATA TRANSFER MODE output (CPU 1 ← DRAM)
PORT C6	TG RESET
PORT C7	Not used

LS139 (IC28) and LS138 (IC15) respectively have address decoder functions. IC28 uses the two high-order address bits A14 and A15, and selects the ROM and RAM chips. IC15 similarly uses the 3 bits A10 to A12, and outputs the chipselection Y0 to Y7 for other chips.

The interface with TG (KLM-782) consists of IC8 (LS245), IC9 (LS367) and IC10 (LS367).

IC25 (LS374) and IC26 (LS374) from a D TYPE FLIP-FLOP, configuring 2 complete input/output systems to the interface circuit with CPU 2 (KLM-781). In addition, IC32 (LS74) performs CPU interrupt control.

Since the FDD cannot be connected directly to the CPU bus, an FDC (FLOPPY DRIVE CONTROLLER) is necessary. In the KLM-780 circuit diagram, IC6 (μPD765A) corresponds to the FDC. Also, data read out from the disk include both CLOCK and DATA which must be separated. DATA SEPARATOR IC7 (SED9420C) is used for this purpose.

The principal functions are as follows. (The FDD control signal output by the FDC is defined as OUT.)

Connector No.	Signal name	IN or OUT	Function
8	INDEX	IN	Outputs 1 pulse every rotation of the FDD.
10	DRIVE SELECT 0	OUT	"L" active when head is accessed.
12	DRIVE SELECT 1	OUT	Not used (only for copying)
16	MOTOR ON	OUT	When "L", motor rotates
18	DIRECTION IN	OUT	"L": Head moves from outside toward center of disk.
20	STEP	OUT	"L" pulse for head movement
22	WRITE DATA	OUT	When changes from "H" to "L", data can be written in. This signal is only effective when WRITE GATE is "L".
24	WRITE GATE	OUT	When "H", READ DATA is effective. When "L", WRITE DATA is effective.
26	TRACK 00	IN	"L" (TRACK 00) when head is in outermost track; otherwise "H". (used to detect head position when power is turned ON).
28	WRITE PROTECT	IN	Judges FD WRITE PROTECT. "H": WRITE PROTECT is released and write-in becomes possible. "L": WRITE PROTECT is effective, and write-in is prevented.
30	READ DATA	IN	FD DATA read-in.
32	SIDE SELECT	OUT	"H": SIDE 0 "L": SIDE 1
34	READY	IN	"L" if disk is inserted and rotates normally when power is turned ON; otherwise, "H".

2. KLM-781

KLM-781 is a CPU2 board.
The CPU2 is 8 bit Microcomputer HD63B03X (IC11) and each port function is as follows.
Additionally Program ROM (IC15) is 16K byte, Work RAM (IC14) is 8K byte.

■CPU2 PORT FUNCTION

Port P20 CV, S/H Channel control Output Port
Port P21 CV, S/H Channel control Output Port
Port P22 CV, S/H Channel control Output Port
Port P23 MIDI IN
Port P24 MIDI OUT
Port P25 CV, S/H INHIBIT 0 - 2 Output Port
Port P26 CV, S/H INHIBIT 0 - 2 Output Port
Port P27 CV, S/H INHIBIT 0 - 2 Output Port

Note:

INHIBIT 0	VCF 0 - 7
INHIBIT 1	VCA 0 - 7
INHIBIT 2-0	DDL1 CV
2-1	CCL2 CV
2-2	NOP
2-3	SAMPLE START
2-4	NOISE
2-5	RESONANCE
2-6	LEVEL 2
2-7	LEVEL 1

Port P54 PROGRAM UP (by FOOT SW) Input Port
Port P55 DAMPER (by FOOT SW) Input Port
Port P60 A/D Input Channel control Output
Port P61 A/D Input Channel control Output
Port P62 A/D Input Channel control Output
Port P63 VCF MODE (24dB/OCT, 12dB/OCT switch)
Port P64 SERIAL CONTROL CLOCK
Port P65 SERIAL CONTROL DATA
Port P66 EQ, DDL1 LEVEL STB
Port P67 DDL2 INPUT SELECT

By Keyboard Scan, lower address (A0 - A3) 4 bit is latched at IC9 (HC77), and is decoded at IC6, IC7 (HC138) and is output to Keyboard Matrix. IC6 is to output address for the first contact, and IC7 is to output address for the second contact.
Keyboard data, such as Note Data, key Velocity Data are read to CPU2 after through Octal Buffer HC240 (IC5).
CV for VCF/A (KLM-783) latches Data Bus D0 - D7 at IC12 (4 bit) and IC13 (8 bit) to control 12 bit DAC BA9221 (IC16). Also, Reference voltage (15V) at DAC is generated at OP AMP 4558 (IC19).
Analog voltage of Slide VRs on the panel goes through Multiplexer 4051 (IC 3) and is converted A/D by CPU2.
IC4 is two-way Data Bus Buffer IC and constructs Interface Circuit with CPU1.

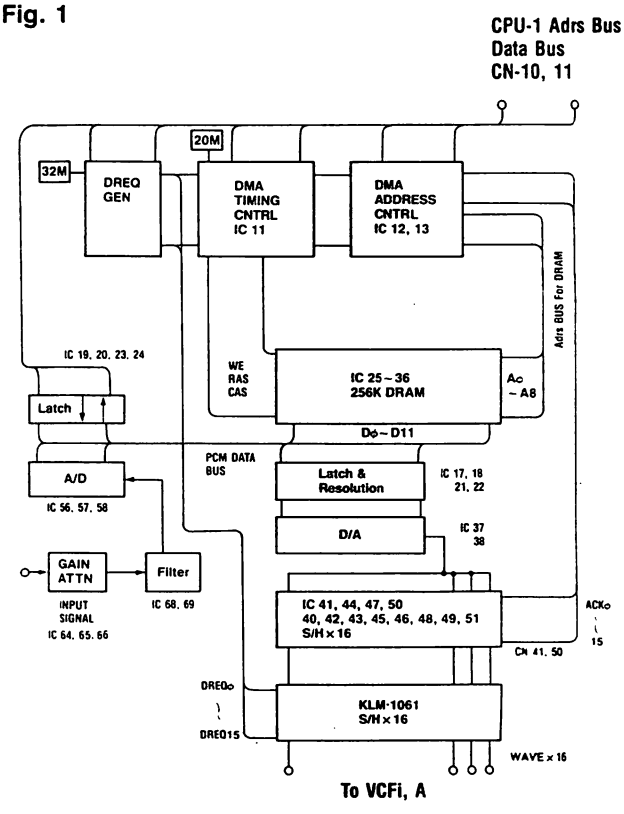
3. KLM-782

KLM-782 is combined with the SAMPLE AND HOLD (S/H) circuit board KLM-1061 to form the DSS-1 TONE GENERATOR (TG) section. The block configuration is as shown in Fig. 1.

■OUTLINE OF FUNCTIONS

1. **Creation of DMA request clock in accordance with command from CPU 1.**
   ICs 1, 2, 3, 6, 7 and 8 are CMOS programmable interval timers which have 3 independent 16-bit counters inside one chip. In combination with the custom gate array μPD65011C-023 (GA-III) (IC4, 5) predivider, they form a 19-bit divider. The master clock is 32 MHz. T0 to T17, which are produced from it, are rectangular waveforms with approximately 50% duty cycles. The frequencies of T0 to T15 vary from 64 Hz to 64 kHz depending on conditions and determine the musical intervals.
   T16 is the ADC system clock with a frequency of about 500 kHz. T17 is a clock with a frequency of about 31 kHz for refreshing DRAM.
   T0 and T1 are the EOC of ADC respectively. In combination with CPU WRITE (Y7), CPU READ (Y14) and the logic formed by IC59, IC60, IC61 and IC62, become DREQ0 and DREQ1 signals only when selected.

Fig. 1



2. Producing timing and addresses for the DRAM (256 K bits × 12)
The above clocks T0 to T15 are input from the GA-I DMA request clock input terminals DREQ0 to DREQ15.
A 16-channel DMA request received by GA-I is encoded by addresses used to specify 3 channels (CH0 to CH2) and three GA-II chip select signals.
Channels 0 to 7 are processed by CSL1 and channels 8 to 15 by CSL2. CSL3 uses the IC15 NAND as the ROW address for refreshing. GA-II processing is done by outputting an acknowledgment (ACK) corresponding to the DREQ channel on GA-I timing, specifying the address in memory by address information, and incrementing the address (DMA ADDRESS CONTROL).

3. Transfer of PCM DATA read out by the DMA from the DRAM to CPU 1
PCM data are latched from CPU 1 to the DRAM by the respective interface circuits listed below, then connected to the data bus.
To the DAC, among the 12 bits from SD0 to SD11 the low-order 6 bits from SD0 to SD5 pass through the logic HC 08 (IC17 and IC18) for resolution to be latched, then are connected to the 12-bit DAC BA9221 (IC37).
D/A resolution is for the purpose of controlling the resolution of the reproduced sound and is controlled by CPU 1 (panel switch parameter 16).

4. SAMPLE AND HOLD (S/H)
The DAC signal output type is converted from current type to voltage type by OP AMP 5534 (IC38).
This output contains a mixture of 16 channels, so S/H is performed for each channel by the ACK signal produced by GA-II, the high-speed analogue switches (HC4066) of IC41, IC44, IC47 and IC50, and the OP AMP.
Connectors CN49 and CN50 can observe waveforms; S/H is performed again by KLM-1061 and noise is removed (the CLOCKs are T2 to T15 and DR1).

5. Audio input signal control
The signal that is input for sampling from connector CN15 enters the filter circuit (panel control by CPU 1) with the GAIN and ATT determined by IC64.
This filter circuit is an LPF formed by operational amplifiers IC67 and IC68; the frequency is 20 kHz. IC67 and IC70 form an absolute value circuit the output of which is read into CPU 2 as an LCD level meter.
IC58 and IC63 produce a trigger which starts sampling. The transition from "H" to "L" is observed at the start of sampling by connector CN12A-9. While the level is "H", GA-I D_0 to D_6 DATA are not read into GA—I (GH).
IC54, IC55, IC56 and IC57 form SAR (Successive Approximation Registers).

4. KLM-783

This circuit board consists of the DSS-1 VCF and VCA sections, and equalizer and noise generator sections. Its outline is as follows.
The VCF/VCA circuit employs 8 custom IC NJM2069BDs (IC101 to IC801) and operates upon receiving control voltage (CV) from CPU 2 (KLM-781).
ICM5201 (IC102 to IC802) selects the VCF output format with software, selects 12 dB/OCT or 24 dB/OCT and inputs VCF output to the 2069 VCA INPUT terminal.
Voice processing of the MULTIPLEX CVs from CPU 2 is performed by the following respective exclusive multiplexers:

VCF:
IC9 (4051) output voltage ±5V; IC5 and IC6 (M5224) form the S/H.

VCA:
IC8 (4051) output voltage 0 to 10V; IC3 and IC4 (M5224) form the S/H.

■NOISE, RESONANCE

OSC MIX RATIO and so on for the other CVs: IC7 (4051) output voltage 0 to 10V; IC1 and IC2 (M5224) form the S/H.
The VCA output for each voice is mixed by a mixer circuit (IC15), enters the equalizer TC9156P (IC16) controlled by CPU 2; then equalizing processing is performed and the result is output from OP AMP 4558 (IC14).
The noise generator is formed by transistor 2SC2785 selected and OP AMP 4558 (IC12). The noise VCA corresponds to transistors Q1 and Q2, and operational amplifier 4558 (IC13).

5. KLM-786

This circuit board, which forms the power supply circuit, consists of the following.

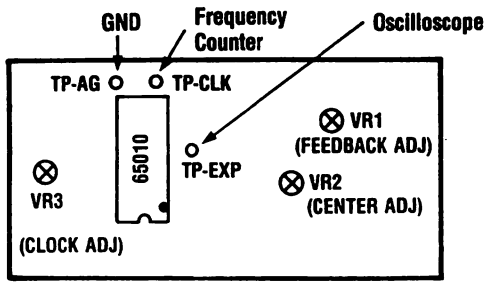
1. Regulators 7805 (IC1) and 7905 (IC2)
... this is a ±5V power supply used principally for VCFA and DDL.

2. Regulators 7812 (IC3) and 7912 (IC4)
... this is a ±12V power supply used mainly for the operational amplifiers.

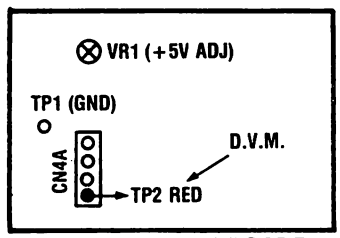
3. Regulators 7812 (IC5)
... this is a +12V power supply used for the FDD motor.

4. Power transistor 2SB533 (Q1)
... this is a +5V 2.5A power supply used for the digital system.

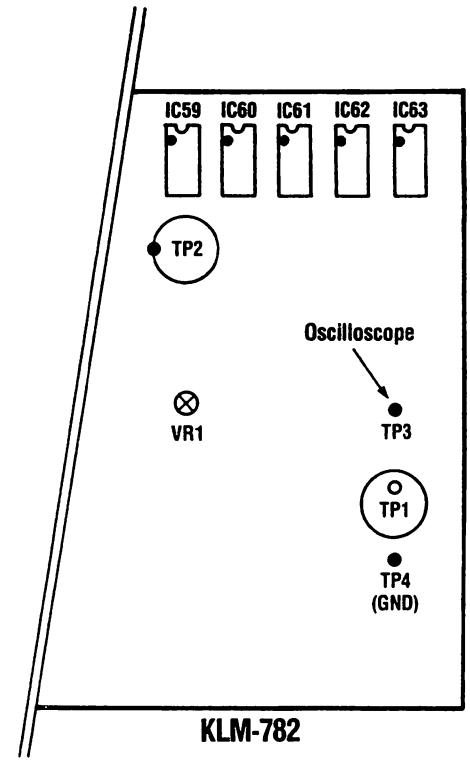
■SEMI-FIXED RESISTOR LOCATION DIAGRAM



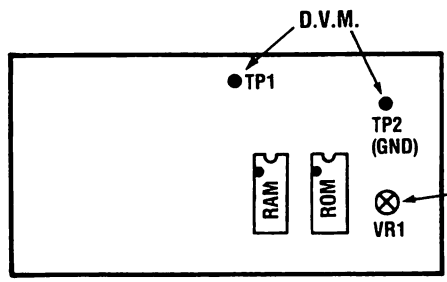
DIGITAL DELAY BOARD KLM-1050



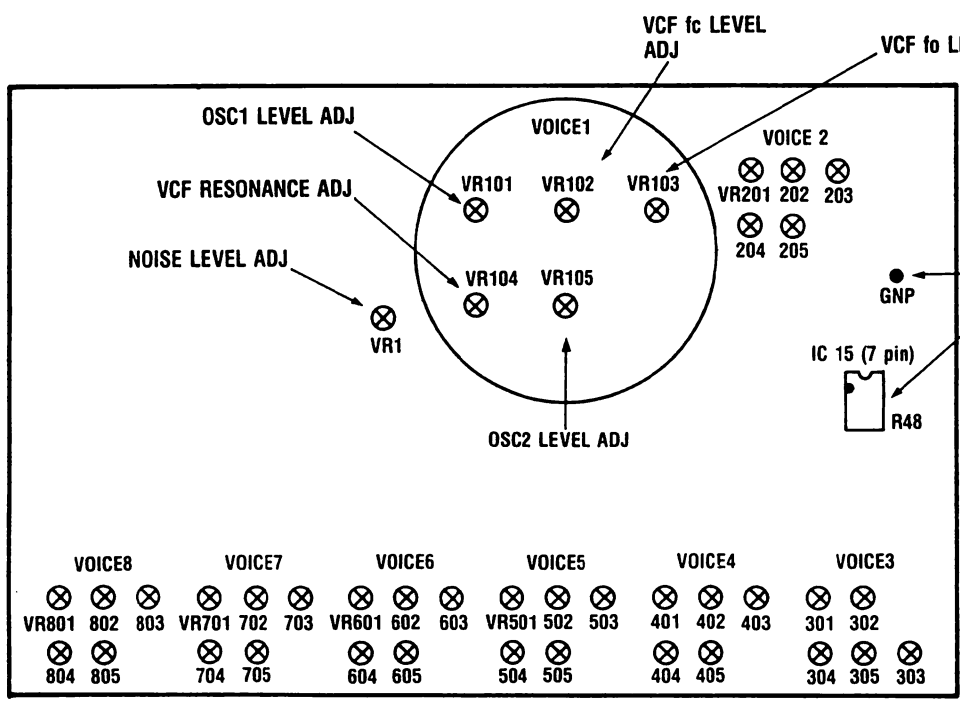
POWER SUPPLY BOARD KLM-786



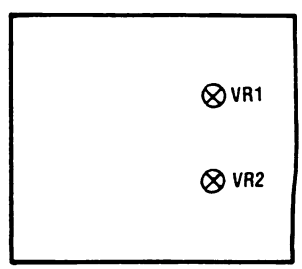
KLM-782



KLM-781



VCF-A BOARD KLM-787



KLM-1049

11. CHECK AND ADJUSTMENT PROCEDURE

■CAUTION

1. This product has been throughly adjusted at the factory before shipment. Therefore never turn any Semi-Fixed VRs other than those required for repair. When adjust Semi Fixed VRs, please refer to Semi-Fixed VR Location Diagram.

2. After turning on Power, wait at least 15 minutes before beginning test and adjustment.
Necessary equipments for the procedure are as follows.
① Oscilloscope ② Digital Volt Meter (DVM) ③ Frequency Counter ④ Noise Meter

- **Power Supply Voltage Check and Adjustment (KLM-786)**

1. Connect a Digital Voltmeter (DVM) to Connector CN4 1 pin (red wire) of KLM-786. (GND to GND on the board)

2. Confirm if the DVM value is within +5V ±0.2V

3. Adjust VR1 if necessary.

Note:
As other Power Supplies ±5V, ±12V are produced by three terminal regulators, adjustment is not necessary.
Deviation of the regulator is less than 20%.

- **DAC Power Supply Check and Adjustment (KLM-781)**

1. Connect a DVM to IC18 1 pin of CPU2 board KLM-781. (GND to GND of the board)

2. Confirm if the DVM value is within +5V±0.2V.

3. Adjust VR1 if necessary.

- **TG Board A/D Check and Adjustment (KLM-782)**

1. Connect an oscilloscope (DC, 2V/div, 5μsec/div) to TP3. (GND to TP4)

Note:
Probe is 10 : 1.

2. Press Sample Key. LED is lit and Display shows as Fig. 1.

Fig. 1

```
*** SAMPLE MODE ***
SELECT S.Frq = 32KHZ
```

3. Press Enter Key

Fig. 2

```
SELECT TOTAL TIME
4.0 or 8.0 (sec)
```

4. Press Enter Key

Fig. 3

```
F1 SMPL-NO. MEN DIV
   01          01
```

5. Press No. 2 Key

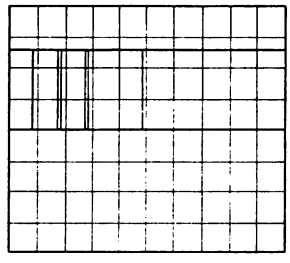
Fig. 4

```
ATTN=00dB GAIN-00dB
*
```

6. Confirm waveform of Fig. 5.

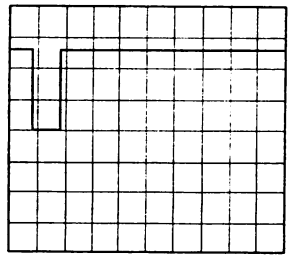
7. Adjust VR 1 if necessary.

Fig. 5



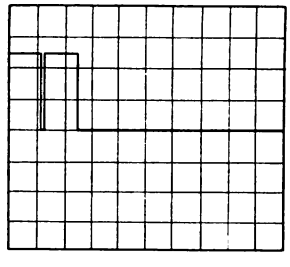
GOOD
Not synchronized with trigger of the oscilloscope.

Fig. 6



NO GOOD
Synchronized with trigger of the oscilloscope. Pulsewaveform from "H" to "L" is observed.

Fig. 7



NO GOOD
Synchronized with trigger of the oscilloscope. Pulsewaveform from "L" to "H" is observed.

Note:
Though it may be difficult, you can get it by adjusting TIME/div value of the oscilloscope within 20μsec. ~ 2μsec.

■TEST DATA DISK

For testing DSS-1, load test data from this disk at first and make it according to following procdure. When data is loaded, display shows as Fig. 8.

Fig. 8

F1 SYS: A Completed Select (1-9):

■PROCEDURE 1.

1. Press System Sw. (LED becomes lit) to call test program. Display shows as Fig. 9.

Fig. 9

SYSA P01: VCA1-R1 VOICE No.1

Now it is in OSC 1 Level Check Mode

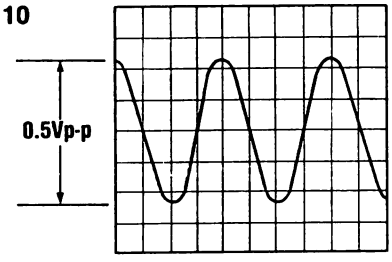
● **OSC 1 Level Check and Adjustment (KLM-783)**

1. Connect an oscilloscope (DC, 0.1V/div., 0.5mS/div) to TP2 (IC15 7 pin). (GND to TP1)

Note:
While checking KLM-783, connect an oscilloscope as above unless specified.

2. Play C4 key to confirm waveform of Fig. 10.

Fig. 10



3. Adjust VR101 if necessary.

4. Repeat above 2), 3) to check Voice 2 — Voice 8 and adjust VR201 — VR801 if necessary.

5. Among the 8 voices, difference of Max. and Min. value must be less than 40mVp-p.

■PROCEDURE 2.

Press up key (▲) of Data Entry to advance program number. Display shows as Fig. 11.

Fig. 11

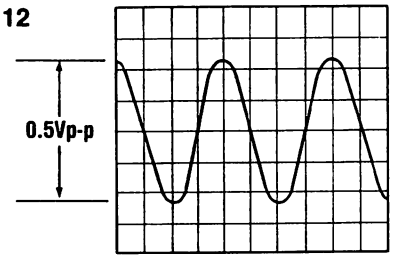
SYSA P02: VCA2-R5 VOICE No.1

Now it is in OSC 2 Level Check Mode

● **OSC 2 Level Check and Adjustment (KLM-783)**

1. Play C4 key to confirm waveform of Fig. 12 (Fig. 10)

Fig. 12



2. Adjust VR105 if necessary.

3. Repeat above 1, 2 to check Voice 2 — Voice 8 and adjust VR205 — VR805 if necessary.

4. Among the 8 voices, difference between Max. and Min. value must be less than 40mVp-p.

■PROCEDURE 3

Press Up Key (▲) of Data Entry to advance program number. Display shows as Fig. 13.

Fig. 13

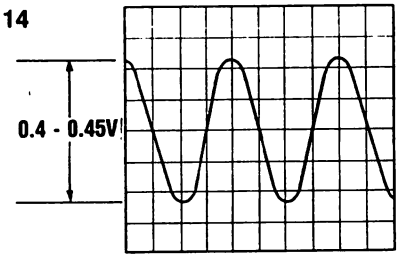
```
SYSA P03: VCFO-R3
VOICE No.1
```

Now it is in VCF fo Check Mode.

● VCF fo level check and Adjustment (KLM-783)

1. Play C4 key and confirm waveform of Fig. 14 (Voice 1)

Fig. 14



2. Adjust VR103 if necessary.
3. Repeat above 1, 2 to check Voice 2 — Voice 8 and adjust VR203 - VR803 if necessary.

Note:
The point of the widest amplitude of the waveform is for adjustment. However as the point of each voice is not completely same, select one point of a voice as a standard adjusting point and adjust other 7 voices with it.

4. Among the 8 voices, difference between Max. and Min. value must be less than 40mVp-p.
5. Play C6 key to confirm if level is as Fig. 14 (Voice 1). (Frequency is about 4 times as much)
6. Adjust VR102 if necessary.
7. Repeat above 5, 6 to check Voice 2 — Voice 8 and adjust VR202 — VR802 if necessary.
8. Among the 8 voices, difference between Max. and Min. value must be less than 40mVp-p.

■PROCEDURE 4

Press Up Key (▲) of Data Entry to advance Program Number. Display shows as Fig. 15.

Fig. 15

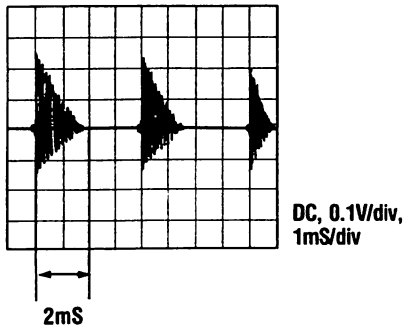
```
SYSA P04: RESO-R4
VOICE No.1
```

Now it is in Resonance Check Mode.

● Resonance Check and Adjustment (KLM-783)

1. Play C4 key to confirm waveform as Fig. 16 (Voice 1)

Fig. 16



2. Confirm if the value of the envelope of resonance oscillation waveform is 2mS. Adjust VR104 if necessary.
3. Repeat above 1, 2 to check Voice 2 — Voice 8. Adjust VR204 — VR804 if necessary.
4. Also confirm if there is no irregular oscillation in each voice.

■PROCEDURE 5

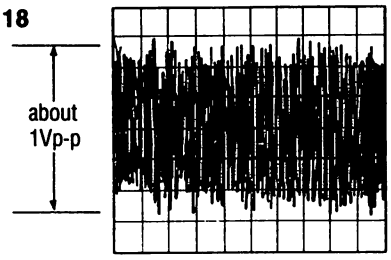
Press Up Key (▲) of Data Entry to advance Program Number. Display shows as Fig. 17.

Fig. 17

SYSA P05: NOISE
VOICE No.1

Now it is in Noise Level Check Mode.

Fig. 18



- **Noise Level Check and Adjustment (KLM-783)**

1. Connect a Noise Meter (1HF-A, −10dBm) to TP1. (GND to TP2)
2. Play any single key to confirm if the meter value is −15dBm.
3. Adjust VR1 if necessary.

■PROCEDURE 6

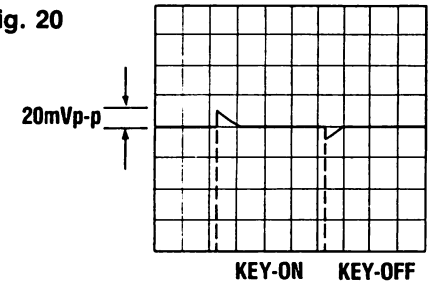
Press Up Key (▲) of Data Entry to advance Program Number. Display shows as Fig. 19.

Fig. 19

SYSA P06: Offset
VOICE No.1

Now it is in DC Offset Check

Fig. 20



- **DC Offset Check (KLM-783)**

1. Setting of the oscilloscope is DC, 5mV/div, 10mS/div.
2. Play C_2, D_2, E_2, F_2, G_2, A_2, B_2, C_3 in order, and confirm waveform of Fig. 20.

Alteration of the signal at Key ON/OFF must be less than 20mV. (With new version, Semi-Fixed VRs for adjusting each voice will be added. VR106 ~ VR806)

■PROCEDURE 7

Press Up Key (▲) of Data Entry to advance Program Number. Display shows as Fig. 21

Fig. 21

SYSA P07: CENTER-1
VOICE No. 1

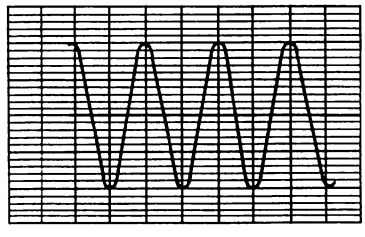
Now it is in DDL-1 Check Mode

Note:
There are two KLM-1050s for DDLs. Placed in the left side of the panel is for DDL-1 and right side is for DDL-2.

- **DDL-1 Clock Check and Adjustment (KLM-1050)**

1. Connect a Frequency Counter to TP-CLK of KLM-1050 fixed in the left side of the panel. (GND to TP-AG).
2. Confirm if the value is 20.0kHz.
3. Adjust VR3 if necessary.
4. Connect an oscilloscope (DC, 0.2V/div, 5mS/div) to TP-EXP. (GND to TP-AG).
5. Play C4 key to confirm waveform of Fig. 22.
6. Adjust VR2 if necessary.

Fig. 22



Note:
Adjust lit line of the oscilloscope to the center and then play C4 key to confirm center of amplitude of the waveform is on the lit line.

■PROCEDURE 8

Press Up key (▲) to advance Program Number. Display shows as Fig. 23.

Fig. 23

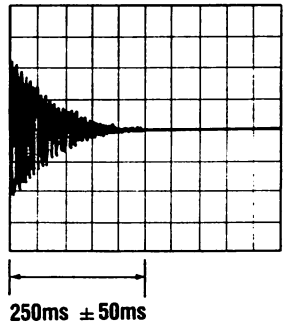
```
SYSA P08: DDL1-Sho
VOICE No.1
```

Now it is in DDL-1 Short Delay Feedback Check Mode.

- **DDL-1 Short Delay Feedback Check and Adjustment**

1. Connect an oscilloscope (DC, 0.2V/div, 50mS/div) to TP-EXP. (GND to AG).
2. Play C4 key to confirm if the decay time of waveform is less than 250ms ±50ms as Fig. 24.

Fig. 24



3. Adjust VR1 if necessary.

■PROCEDURE 9

Press Up key (▲) of Data Entry to advance Program Number. Display shows as Fig. 25.

Fig. 25

```
SYSA P09: CENTER-2
VOICE No.1
```

Not it is in DDL-2 Check Mode.

Note:
Refer to Procedure 7 as everything is quite same except DDL-2 board (KLM-1050) being in the right side of the panel.

■PROCEDURE 10

Press Up key (▲) of Data Entry to advance Program Number. Display shows as Fig. 26.

Fig. 26

```
SYSA P10: DDL2-Sho
VOICE No.1
```

Now it is in DDL-2 Short Delay Feedback Check Mode.

- **DDL-2 Short Delay Feedback Check Mode (KLM-1050)**

Note:
Refer to Procedure 8 as everything is quite same.

■PROCEDURE 11

Press Up key (▲) of Data Entry to advance Program Number. Display shows as Fig. 27.

Fig. 27

```
SYSA P11: DDL1-Lon
VOICE No.1
```

Now it is in DDL-1 Long Delay Check Mode.

- **DDL-1 Long Delay Check Mode (KLM-1050)**

1. Play C5 key to confirm delay sound of line-out "L" starts to decay after about 2 sec. without oscillation.

■PROCEDURE 12

Press Up key (▲) of Data Entry to advance Program Number. Display shows as Fig. 28.

Fig. 28

```
SYSA P12: DDL2-Lon
VOICE No.1
```

Now it is in DDL-2 Long Delay Check Mode.

● DDL-2 Long Delay Check Mode (KLM-1050)

1. As Procedure 11, play C4 key to confirm if delay sound of line-out "R" starts to decay after about 2 sec. (Sound check just by listening is enough.)

■PROCEDURE 13

Press Up key (▲) of Data Entry to advance Program Number. Display shows as Fig. 29.

Fig. 29

```
SYSA P13: DDL-MUT
VOICE No.1
```

Now it is in Delay Time Mute Check Mode

● Delay Time Mute Check Mode

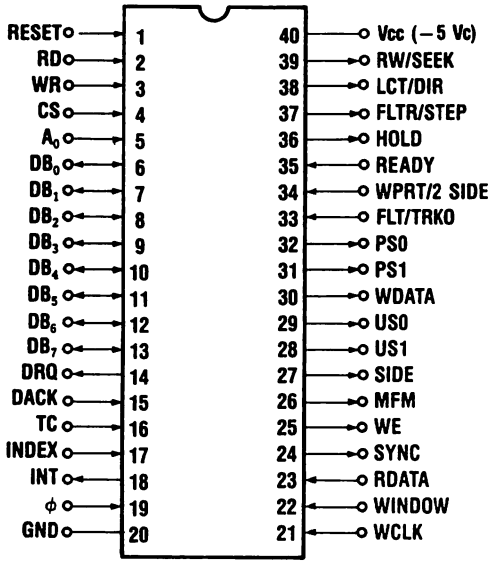
1 Press Mode Sw. (Program/Parameter) and select Parameter No. 81 (Delay Time).
2 While pressing any single key, move Data Entry B Slider randamly.
3 Confirm if Delay Time is changed following the Slider's move, and if the mute is on the sound when the time is changed.
4 Repeat above 1 ~ 3 to check DDL-2 with Parameter Number 92.

REFERENCE DATA

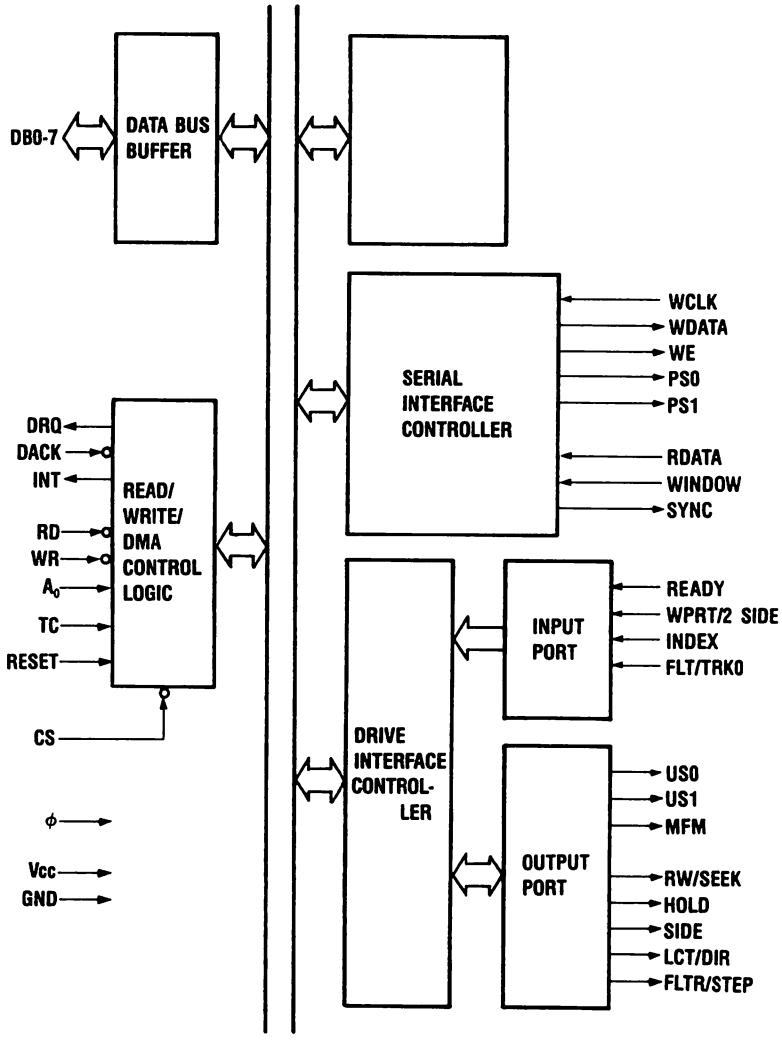
Here we are introducing newly adopted parts for DSS-1 mainly. However, please note, though they are same name, such as CPU8085, processing speed of the one for DSS-1 is much faster than the one for POLY-800 and not compatible each other. If misused, malfunction will happen. For those parts in replacing and ordering, please refer to our parts list. They are listed separately with different code number.

1. PROGRAMMABLE FLOPPY DISK CONTROLLER μPD-765A

■ PIN CONFIGURATION



■ BLOCK DIAGRAM



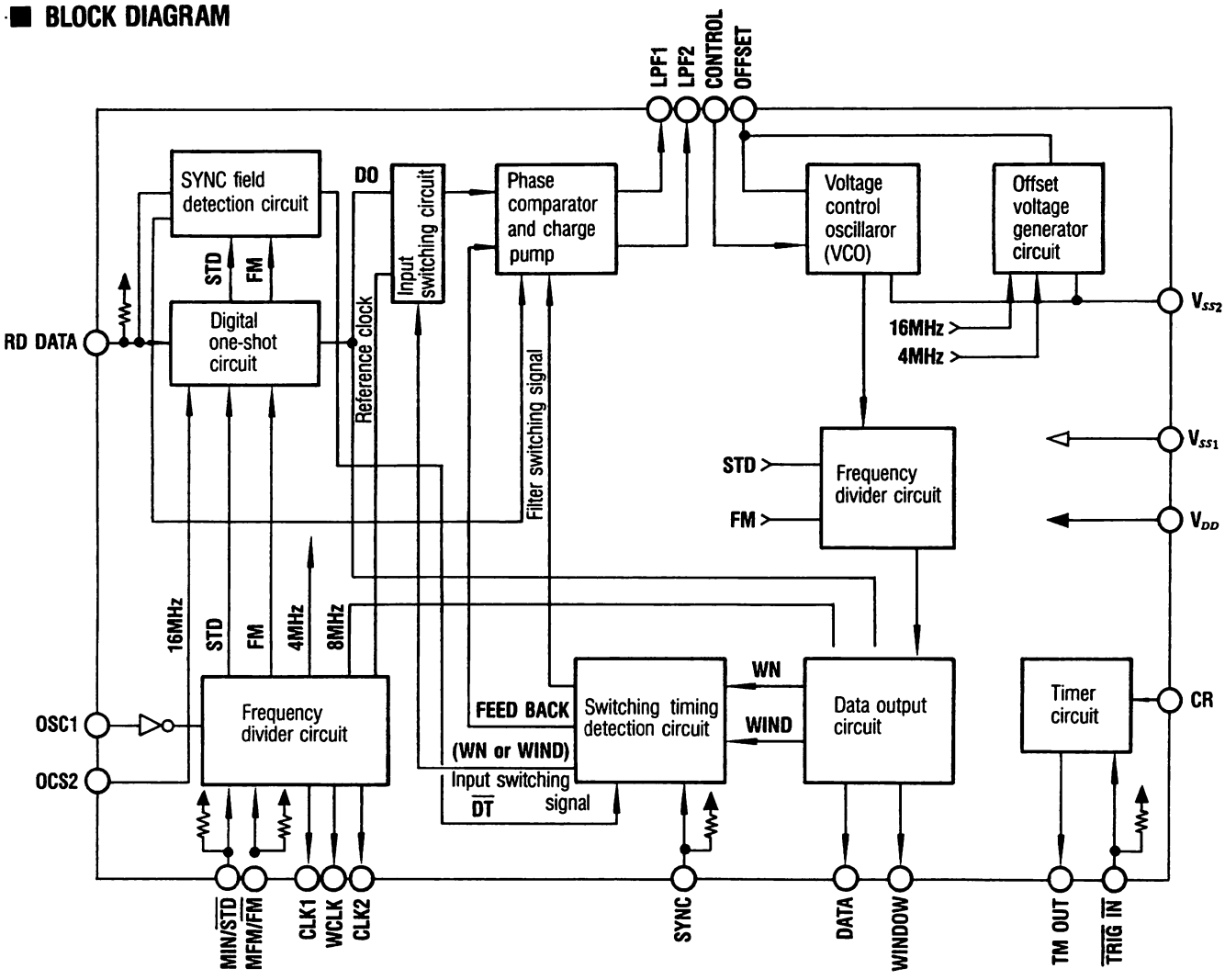
■ TERMINAL DESCRIPTION

μPD7265 terminal functions

Terminal name	I/O	Function	Condition when reset
RESET	I	Puts the FDC in idling condition. • Sets the drive interface outputs to "LOW" except for PS0, PS1 and WDATA (undetermined). • On the main system side, sets INT and DRQ to "LOW" and DB_7 to DB_0 in input condition.	—
RD	I	Control signal for making the main system read out data from FDC to data bus.	
WR	I	Control signal for making the main system write data from data bus into FDC.	
CS	I	Makes RD and WR signals effective.	
A_0	I	Signal for the purpose of selecting status register or data register inside FDC through the address bus. When 0 the status register is selected; when 1 the data register is selected.	
$DB_7 \sim DB_0$	I/O	Data bus for 3 states in both directions.	Input
DRQ		Signal to request data transfer in DMA mode. A pull-up resistor is required except for the μPD765AC-2.	Low
DACK	I	DMA cycle permission signal.	—
TC	I	Data transfer completion indication signal.	
INDEX	I	Signal to indicate that drive read/write head has reached physical starting position of track on medium.	
INT	O	Signal to request the main system to perform processing of transferred data and execution results for main system.	Low
ϕ	I	Single-phase, TTL level clock; requires pull-up resistor. Standard floppy: 8 MHz; mini floppy: 4 MHz	—
WCLK	I	Timing signal for data transferred during writing. Must also be input during reading for subsequent use. Please synchronize rise with rise of ϕ. FM: $16\phi_{cy}$; MFM: $8\phi_{cy}$ (ϕ_{cy}: period of ϕ input).	
WINDOW	I	Signal which is formed by VFO circuit. Used to sample RDATA clock bit and data bit. Judgment as to whether clock bit or data bit is to be sampled is done inside the FDC.	
HOLD	O	Signal to set drive read/write head in load condition.	Low
FLTR/STEP	O	This signal becomes FLTR when RW is specified as RW/SEEK signal; releases drive FAULT condition. When SEEK is specified as RW/SEEK signal, this becomes STEP, and a seek pulse is generated.	
LCT/DIR	O	When RW is specified as RW/SEEK signal this becomes LCT and indicates that the drive read/write head has selected the 43rd or a subsequent cylinder. When SEEK is specified as RW/SEEK signal this becomes DIR and indicates the direction of the seek action. When 0 it is away from the center; when 1 it is toward the center.	
RW/SEEK	O	Among the drive interface signals, this identifies those which can also be used for read/write or for seek. When 0, indicates RW; when 1, indicates SEEK.	
Vcc	—	+5V power supply	—
GND	—	Ground	

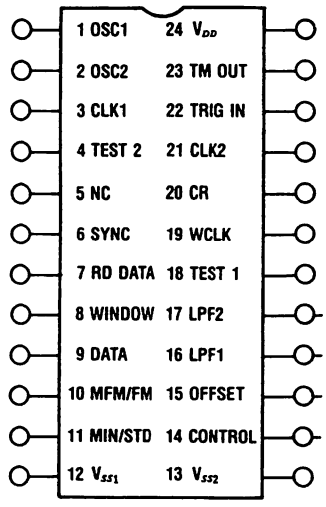
CMOS DATA SEPARATOR SED 9420C

■ BLOCK DIAGRAM



■ PIN CONFIGURATION

SED 9420C

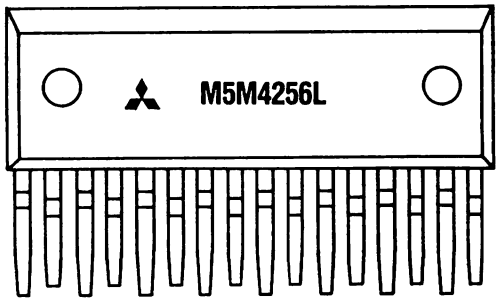


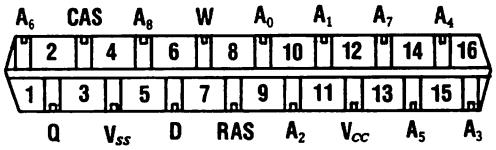
■EXPLANATION OF TERMINALS

Terminal No.	Terminal Name	Function
1	OSC1	(1) Inversion amplifier gate input terminal for crystal oscillator circuit (2) Input terminal for 16 MHz external clock input.
2	OSC2	Inversion amplifier drain output terminal for crystal oscillator circuit.
3	CLK1	Clock (μPD765 system) output terminal used for FDC. • 8-inch floppy: frequency f = 8 MHz • 5-inch floppy: frequency f = 4 MHz
4	TEST2*	Test terminal (with pull-up resistor) for function confirmation.
5	NC	Not connected.
6	SYNC*	Control input signal from FDC for the purpose of detecting the GAP region and SYNC region (with pull-up resistor).
7	RD DATA*	Input terminal for read data signal from floppy disk drive (FDD) (with pull-up resistor)
8	WINDOW	Output terminal for DATA WINDOW signal used to divide DATA signal into data pulse and clock pulse.
9	DATA	Output terminal for data signal produced from RD DATA signal. Read into FDC together with WINDOW signal, then separated into data pulse and clock pulse.
10	MFM/FM	Terminal for switching between double density and single density recording format (with pull-up resistor). • Double density (MFM): high level • Single density (FM): low level
11	MIN/STD*	Terminal for switching between 5-inch floppy disk and 8-inch floppy disk (with pull-up resistor). • 5-inch floppy: high level • 8-inch floppy: low level
12	V_{SS1}	Digital system ground terminal.
13	V_{SS2}	Analogue system ground terminal (VCO section ground).
14	CONTROL	Input terminal for VCO (Voltage Controlled Oscillator) section control voltage.
15	OFFSET	Input terminal for applying offset voltage for the purpose of correcting the VCO section oscillation center frequency (offset voltage is generated using external capacity)
16	LPF1	Terminal for connecting loop filter in PLL system. Selected when frequency is pulled in following sink field detection.
17	LPF2	Terminal for connecting loop filter in PLL system; selected when reading ID and data after frequency is pulled in.
18	TEST1	Test terminal used for function checking. (normally not connected).
19	WCLK	Write in clock for FDC (φPD765 system). • 8-inch floppy/MFM: 5 = 1 μS • 8-inch floppy/FM : T = 2 μS • 5-inch floppy/MFM: T = 2 μS • 5-inch floppy/FM : T = 4 μS
20	CR	C-R externally attached terminal used for timer circuit.
21	CLK2	Clock used for FDC (MB8877 system, FD179X system). • 8-inch floppy: frequency f = 2 MHz • 5-inch floppy: frequency f = 1 MHz
22	TRIG IN*	Trigger input terminal for timer circuit (with pull-up resistor).
23	TM OUT	Timer circuit output terminal (timer used to set head load time, motor stop time, etc.)
24	V_{DD}	+5V line voltage terminal.

DRAM M5M4256L (256K × 1 bit)

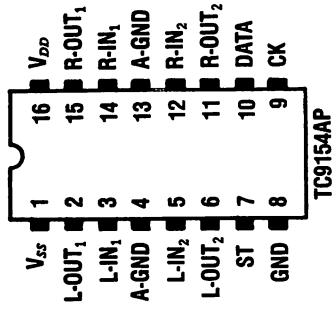
■ PIN CONFIGURATION



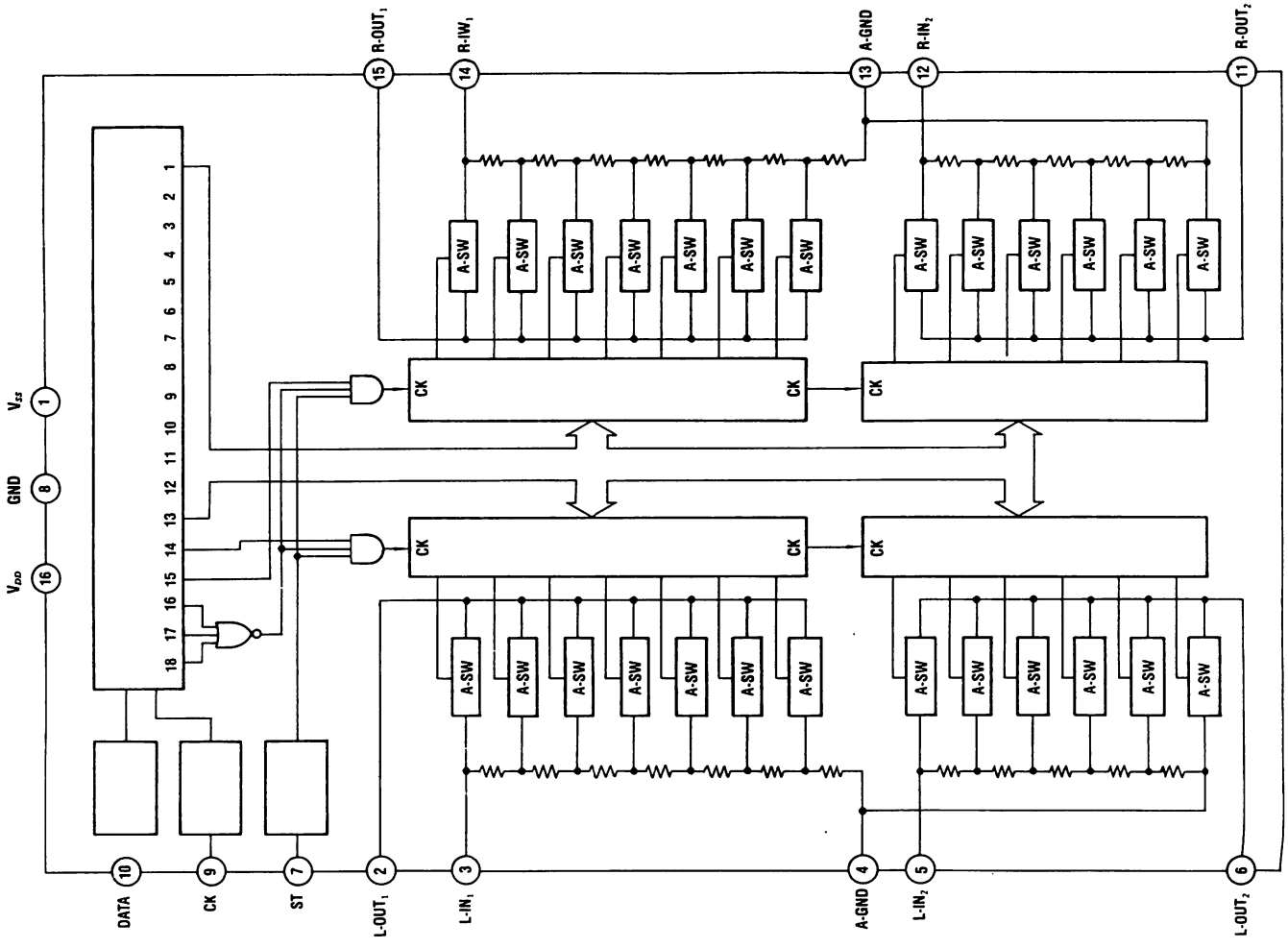


(BOTTOM VIEW)

■ TC 9154 AP PIN CONFIGURATION



■ TC 9154 AP BLOCK DIAGRAM



■TC 9153AP/TC9154AP EXPLANATION OF TERMINAL FUNCTIONS

Terminal No.	Symbol	Explanation of function	Remarks
1	V_{BB}	Terminal for applying (−) power.	
2	L-OUT1	10 dB step attenuator output. Signal applied to IN is attenuated from 0 to −60 dB in seven 10 dB steps.	Left/right symmetry
3	$L\text{-}IN_1$	10 dB step attenuator input.	
4	A-GND	AC ground terminal.	
5	$L\text{-}IN_2$	2 dB step attenuator input.	
6	$L\text{-}OUT_2$	2 dB step attenuator output. Signal applied to IN is attenuated from 0 to 8 dB in five 2 dB steps.	
7	ST	Strobe input terminal. Attenuation amount and channel selection signals taken in at DATA and CK terminals are latched by putting this terminal at "H" level. When "H" level is not applied to this terminal, the previous data remain as they were.	
8	GND	Ground terminal for only TC9154AP	
9	CK	Clock input terminal. Clock input for purpose of taking data in from data terminal.	
10	DATA	Attenuation amount and channel selection data input terminal. Input as CK signal consisting of 18 bits.	
11	$R\text{-}OUT_2$	2 dB step attenuator output. Signal applied to IN is attenuated from 0 to 8 dB in five 2 dB steps.	
12	$R\text{-}IN_2$	2 dB step attenuator input.	
13	A-GND	AC ground terminal.	
14	$R\text{-}IN_1$	10 dB step attenuator input.	
15	$R\text{-}OUT_1$	10 dB step attenuator output. Signal applied to IN is attenuated from 0 to −60 dB in seven 10 dB steps.	
16	V_{DD}	Terminal for applying (+) power.	

■GA-1 TERMINAL DESCRIPTION

NO.	PIN NAME	I/O	FUNCTION
1	MCLKI	I	Master clock 20MHz
2	VDD		+5V
3	GND		GND
4	N.C.		N.C.
5	N.C.		N.C.
6	RESET	I	System Reset
7	REFE	I	CONNECT to GND
8	GATE H	I	impossible to write data while "H"
9	N.C.		N.C.
10	N.C.		N.C.
11	MPUE	I	Timing Clock
12	CS	I	at 'L', read D0-D6 and D7 output
13	RDWT	I	at 'H', D7 output "L", D0-D6 latch
14	D0	I	Data Bus
15	D1	I	Data Bus
16	D2	I	Data Bus
17	D3	I	Data Bus
18	D4	I	Data Bus
19	D5	I	Data Bus
20	D7	O	Data Bus
21	D6	I	Data Bus
22	GND		GND
23	VDD		+5V
24	N.C.		N.C.
25	CSL3	O	GA-II Refresh
26	CSL2	O	Chip Select
27	CSL1	O	Chip Select
28	CH0	O	Address to show DMA Request CH
29	CH1	O	Address to show DMA Request CH
30	CH2	O	Address to show DMA Request CH
31	RLEN	O	Signal to generate CAR latch timing
32	DWEN	O	Write enable for DRAM
33	GND	O	GND
34	START	O	Timing signal for GATE-ON
35	N.C.	O	N.C.
36	SHT	O	Timing for S/H/Waveform data latch
37	EOP	I	DRAM writing Mode cancel
38	DLE	O	Waveform data latch timing/S/H timing reset
39	RAS	O	ROW (ROM) Address STROBE
40	CAS	O	Column Address STROBE

NO.	PIN NAME	I/O	FUNCTION
41	N.C.		N.C.
42	VDD		+5V
43	GND		GND
44	SINBIT	I	ZERO CROSS DETECTION
45	DTOE	O	Data Input Enable
46	DREQ0	I	DMA request
47	DREQ1	I	DMA request
48	DREQ2	I	DMA request
49	DREQ3	I	DMA request
50	DREQ4	I	DMA request
51	DREQ5	I	DMA request
52	DREQ6	I	DMA request
53	DREQ7	I	DMA request
54	DREQ8	I	DMA request
55	DREQ9	I	DMA request
56	DREQ10	I	DMA request
57	DREQ11	I	DMA request
58	DREQ12	I	DMA request
59	DREQ13	I	DMA request
60	DREQ14	I	DMA request
61	DREQ15	I	DMA request
62	GND		GND
63	VDD		+5V
64	DREQ16	I	GND
65	DREQ17	I	GND
66	DREQ18	I	GND
67	DREQ19	I	GND
68	DREQ20	I	GND
69	DREQ21	I	GND
70	DREQ22	I	GND
71	DREQ23	I	GND
72	N.C.	I	NC
73	RDY	I	Expand cycle of reading/writing
74	N.C.		N.C.
75	RD50	O	Interval 500nS
76	N.C.		N.C.
77	SDLY	I	Expand cycle of reading/writing
78	N.C.		N.C.
79	LD45	O	Interval 450nS
80	N.C.		N.C.

■GA-2 TERMINAL DESCRIPTION

NO.	PIN NAME	I/O	FUNCTION
1	N.C.		N.C.
2	VDD		+5V
3	GND		GND
4	N.C.		N.C.
5	CS	I	CHIP SELECT active "L"
6	E	I	ENABLE
7	RESET	I	RESET active "L"
8	N.C.		N.C.
9	N.C.		N.C.
10	A0	I	ADDRESS BUS
11	A1	I	ADDRESS BUS
12	A2	I	ADDRESS BUS
13	A3	I	ADDRESS BUS
14	D0	I	Data Bus
15	D1	I	Data Bus
16	D2	I	Data Bus
17	D3	I	Data Bus
18	D4	I	Data Bus
19	D5	I	Data Bus
20	D6	I	Data Bus
21	D7	I	Data Bus
22	GND		GND
23	VDD		+5V
24	DA0	O	Address for DRAM
25	DA1	O	Address for DRAM
26	DA2	O	Address for DRAM
27	N.C.		N.C.
28	N.C.		N.C.
29	N.C.		N.C.
30	DA6	O	Address for DRAM
31	DA7	O	Address for DRAM
32	DA8	O	Address for DRAM
33	GND		GND
34	N.C.		N.C.
35	N.C.		N.C.
36	N.C.		N.C.
37	N.C.		N.C.
38	N.C.		N.C.
39	N.C.		N.C.
40	N.C.		N.C.

NO.	PIN NAME	I/O	FUNCTION
41	N.C.		N.C.
42	VDD		+5V
43	GND		GND
44	N.C.		N.C.
45	N.C.		N.C.
46	N.C.		N.C.
47	N.C.		N.C.
48	N.C.		N.C.
49	N.C.		N.C.
50	N.C.		N.C.
51	N.C.		N.C.
52	N.C.		N.C.
53	N.C.		N.C.
54	ACK0	O	Signal for Waveform data latch/S/H
55	ACK1	O	Signal for Waveform data latch/S/H
56	ACK2	O	Signal for Waveform data latch/S/H
57	ACK3	O	Signal for Waveform data latch/S/H
58	ACK4	O	Signal for Waveform data latch/S/H
59	ACK5	O	Signal for Waveform data latch/S/H
60	ACK6	O	Signal for Waveform data latch/S/H
61	ACK7	O	Signal for Waveform data latch/S/H
62	GND		GND
63	VDD		+5V
64	DA5	O	Address for DRAM
65	DA4	O	Address for DRAM
66	DA3	O	Address for DRAM
67	RAS	I	
68	DLE	I	Waveform data latching & S/H timing reset
69	EOP	O	DRAM writing mode cancel
70	SHT	I	Timing for S/H/Waveform data latch
71	REFSH	I	Row address for refresh
72	START	I	Timing signal for GATE ON
73	N.C.		N.C.
74	RLE	I	Generate INTERNAL latch timing
75	N.C.		N.C.
76	MSIZE	I	Decide DRAM memory size (256K at "H")
77	CH2	I	Address to show DMA request channel
78	CH1	I	Address to show DMA request channel
79	CH0	I	Address to show DMA request channel
80	CHS	I	Chip select

FLOPPY DISK DRIVE MD350

■PERFORMANCE SPECIFICATIONS

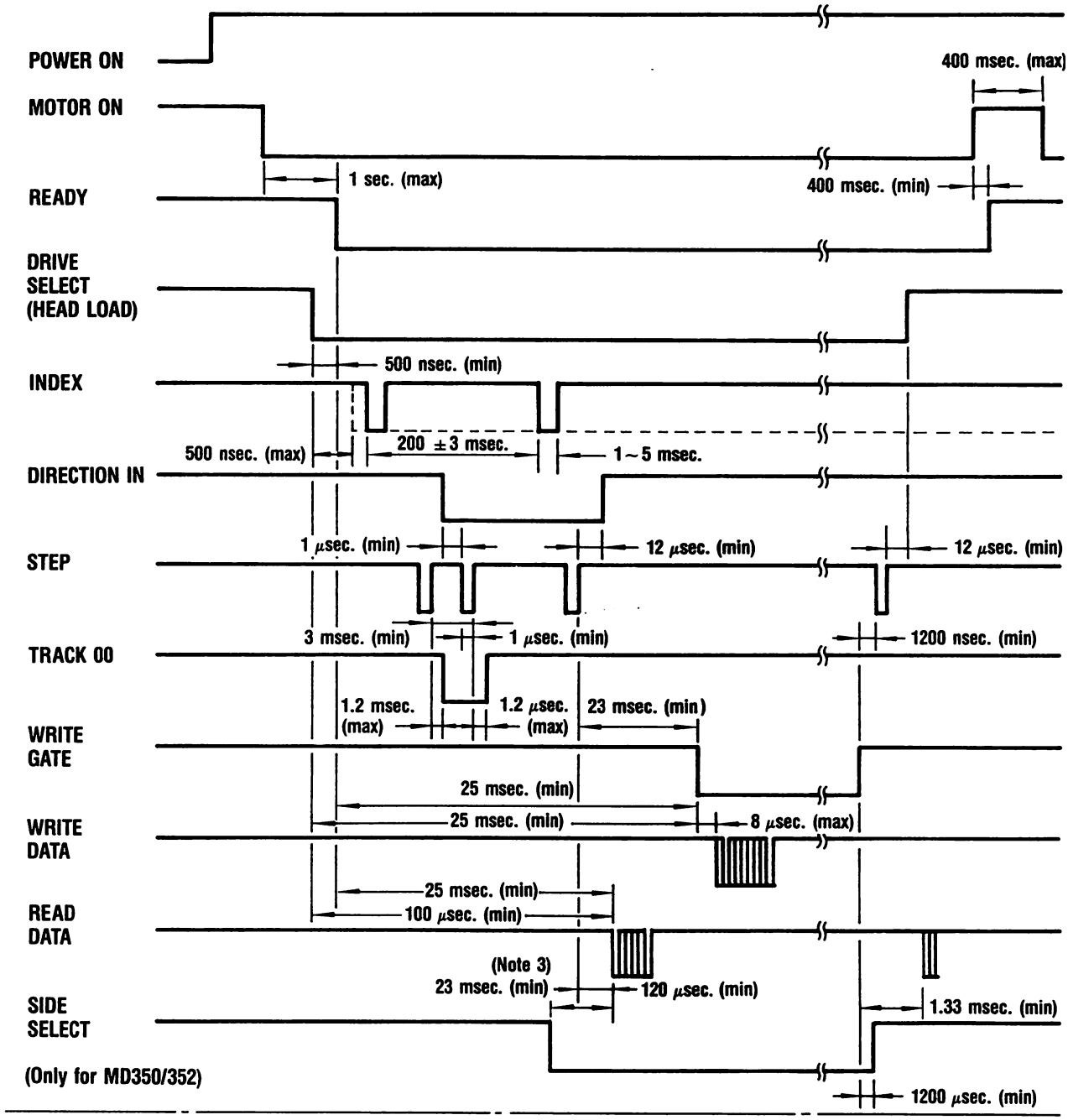
	MD350
	Double density/Single density
Recording capacity Disk capacity (Bytes) Track capacity (Bytes)	1M/500K 6.25K/3.125K
Average waiting time	100 msec.
Access time Time for movement between tracks	3 msec.
Average access time	100 msec.
Head setting time	20 msec.
Head loading time (Note 1)	25 msec.
Motor starting time (Note 2)	500 msec.
Data transfer speed	Double density: 250K bits/sec. Single density: 125K bits/sec.

Note 1)
Only when optional accessory solenoid is installed.
Note 2)
Under chucked condition

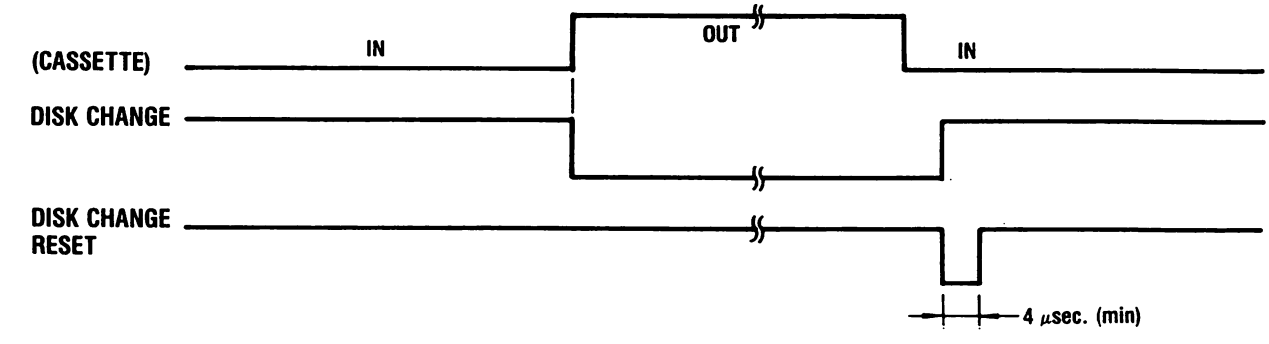
■FUNCTIONAL SPECIFICATIONS

Recording density on innermost track (BPI)	
(TRACK/SIDE) Number of tracks (TRACK/DISK)	
Track density (TPI)	
Outer circumference Track radius Inner circumference	
Modulation system	MFM or FM

■ENVIRONMENTAL CONDITIONS



DISK CHANGE TIMING (Option)



TROUBLESHOOTING GUIDE

In this chapter, a simple explanation is given of how to troubleshoot the DSS-1.

Note:
Checking of the WAVE RAM on the TG circuit board (KLM-782) and the floppy disk drive are explained in the description of the special test program (p.32).

■Start the system up as follows.

1. Turn the power switch ON. The LCD indication is shown in Fig. 1.

Fig. 1

```
*** KORG DSS-1 ***
SAMPLING SYNTHESIZER
```

2. Two to three seconds later, the LCD indication becomes as shown in Fig. 2.

Fig. 2

```
*** SYSTEM MODE ***
SELECT (1-9): _
```

3. Insert an accessory floppy disk into the floppy disk drive. Turn No. 1 key On (GET SYSTEM). The LCD indication becomes as shown in Fig. 3 and the ENTER key LED flashes.

Fig. 3

```
F1 GET SYSTEM: A
Select & Press ENTER
```

4. When the ENTER key is turned ON, the ENTER key LED goes off and the indication becomes as shown in Fig. 4.

Fig. 4

```
F1 GET SYSTEM: A
Are you sure (Y/N)
```

5. Now if the YES key is turned ON, the floppy disk drive is accessed, and the indication becomes as shown in Fig. 5.

Fig. 5

```
F1 Loading...
Please Wait a Minute
```

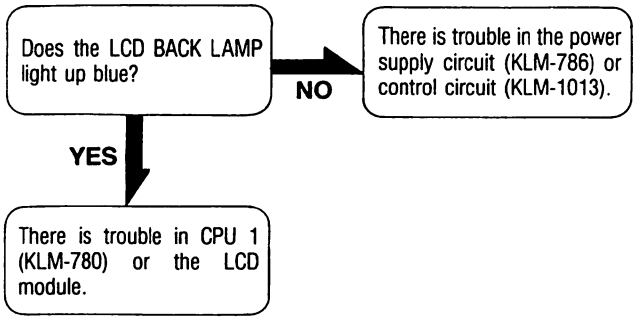
6. When loading is completed, the indication becomes as shown in Fig. 6 and normal pronunciation is performed, producing a sound indicating that all keys have been loaded.

Fig. 6

```
F1 SYS: A Completed
Select (1-9): _
```

■PROBLEM 1

The indication in Fig. 1 does not appear. (Note: It can also happen that the indication appears but the BACK lamp does not light up.)



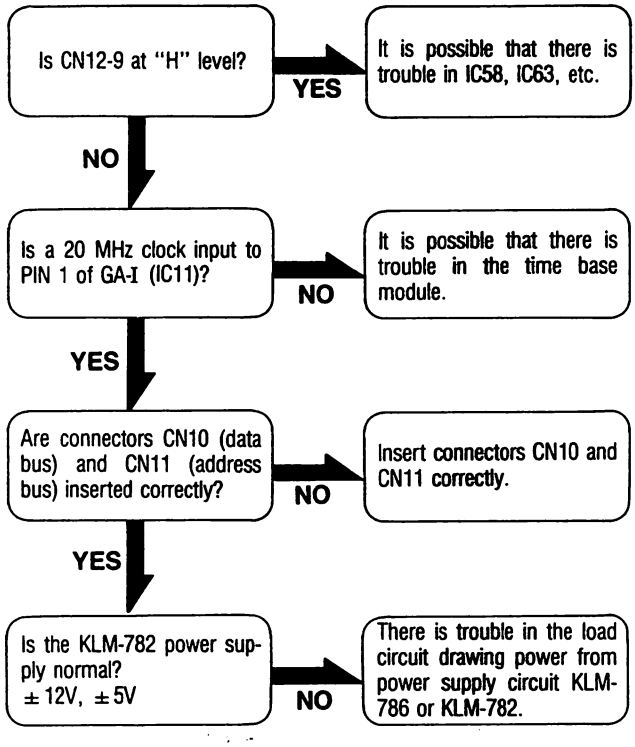
Which unit is bad can be judged by successively replacing first KLM-780 (or part thereof) and then the LCD module by good units. If the trouble is in KLM-780, check the CPU, ROM RAM and I/O (8155). In the case of the LCD module, the entire module has to be replaced.

■PROBLEM 2

The indication in Fig. 1 appears but fails to progress to the indication in Fig. 2.
There is trouble in CPU 1 (KLM-780) or TG (KLM-782). Which one the trouble is in can be judged by replacing each circuit board in turn with a good one.
If the trouble is in CPU 1, it is necessary to check the CPU, ROM, RAM and TG interface.
If the trouble is in the TG, check according to the following procedure.

Remark:
The steps up to here do not determine which part of a circuit board is bad. Replace KLM-782 (if necessary return it to KORG).

- **Check KLM-782 connector CN12-9 with an oscilloscope.**



■PROBLEM 3

The indication does not progress from Fig. 2 to Fig. 3 or Fig. 4 (switch input is not received).
The trouble could be in the CPU 1 circuit board (KLM-780) or the panel switch circuit board. Check the switch scan circuit in IC14 (8255) on KLM-780 and the connected harnesses and connectors.

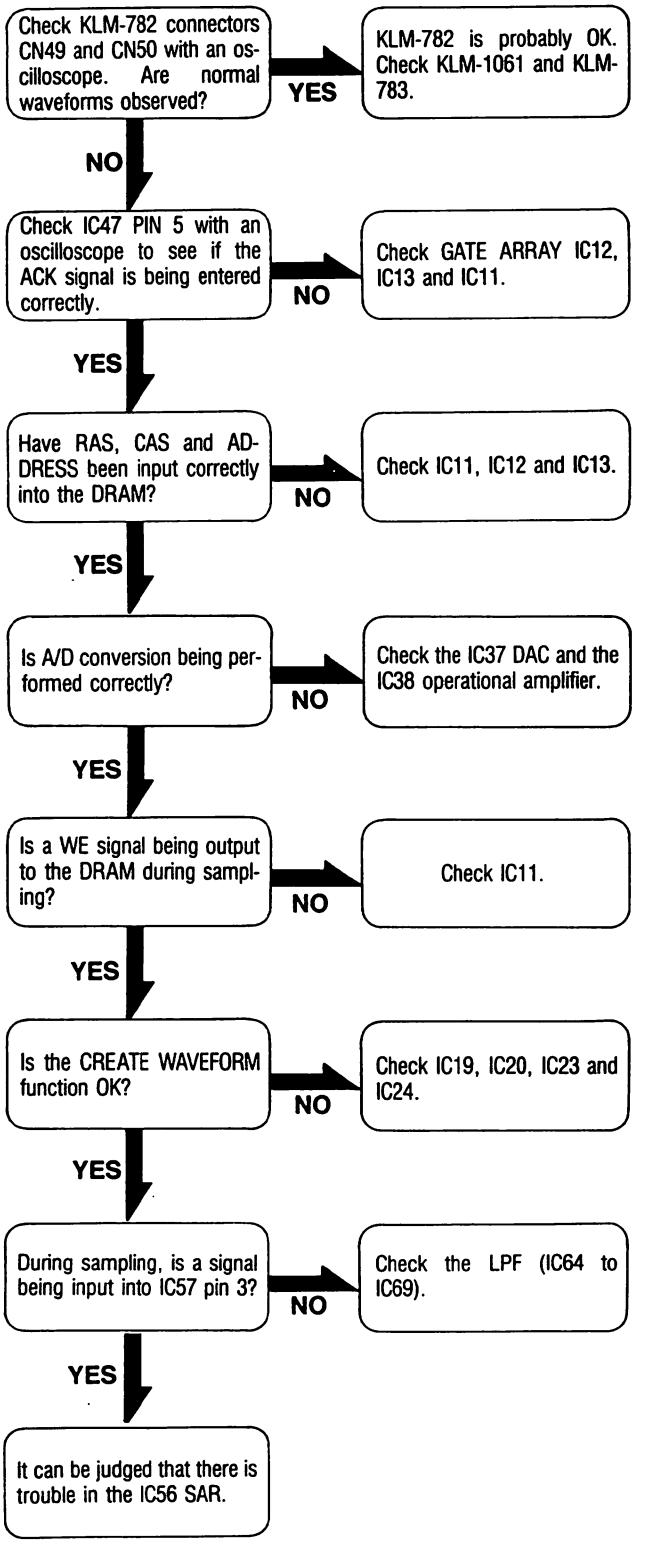
■PROBLEM 4

GET is not performed normally, or while GET is in progress an error message appears or the indication remains stuck on Fig. 5.
The trouble could be in the KLM-780 FDC or FDD.

Perform the FDD test which is described separately. If there is trouble in the FDD, replace it with a good one. Check the KLM-780 FDC referring to p.46.

■PROBLEM 5

After the indication as shown in Fig. 6 is given, no sound comes out at all.
Check according to the following procedure; mainly check the TG circuit board.



Remarks:
Keyboard scan assignment is being done by CPU 2 (KLM-781), so also check the KBD MATRIX circuit at the same time.
The basic method of checking if no sound comes out in case of a special voice is the same as for PROBLEM 5.

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
	CARBON RESISTORS			
10413210	S1/4JYTP 10 OHM	KLM-784		2
10413222	S1/4JYTP 22 OHM	KLM-786/10		1
10413268	S1/4JYTP 68 OHM			1
10413282	S1/4JY 82 OHM	KLM-785/10		1
10413310	S1/4JYTP 100 OHM	KLM-784		4
10413322	S1/4JYTP 220 OHM	KLM-788		3
10413327	S1/4JYTP 270 OHM	KLM-785/10		6
10413330	S1/4JYTP 300 OHM	KLM-784		1
10413333	S1/4JYTP 330 OHM			1
10413347	S1/4JYTP 470 OHM			1
10413362	S1/4JYTP 620 OHM	KLM-788		1
10413410	S1/4JYTP 1K	KLM-786/10		1
		KLM-788		2
10413422	S1/4JYTP 2.2K			2
10413447	S1/4JYTP 4.7K	KLM-785/10		5
10413510	S1/4JYTP 10K	KLM-784		3
		KLM-788		2
10413522	S1/4JYTP 22K	KLM-784		3
		KLM-786/10		1
10413547	S1/4JYTP 47K	KLM-784		3
		KLM-785/10		1
10413610	S1/4JYTP 100K	KLM-784		5
		KLM-788		2
10413633	S1/4JYTP 330K	KLM-784		1
10413710	S1/4JYTP 1M			1
		KLM-786/10		1
10416000	1/6JTP 0 OHM	KLM-780		2
		KLM-781		2
		KLM-782		6
		KLM-783		5
		KLM-788		3
		KLM-1049		1
10416222	1/6JTP 22 OHM	KLM-1050		4
10416233	1/6JY 33 OHM	KLM-781		1
10416247	1/6JTP 47 OHM	KLM-783		11
		KLM-1061		16
10416268	1/6JTP 68 OHM	KLM-782		9
10416310	1/6JTP 100 OHM			1
		KLM-1050		8
10416315	1/6JTP 150 OHM	KLM-1049		2
10416322	1/6JTP 220 OHM	KLM-782		1
		KLM-783		18
10416333	1/6JTP 330 OHM	KLM-780		1
		KLM-782		1
10416347	1/6JTP 470 OHM	KLM-782		3
10416351	1/6JTP 510 OHM			1
		KLM-1050		2
10416356	1/6JTP 560 OHM			2
10416410	1/6JTP 1.0K	KLM-781		5
		KLM-782		3
		KLM-783		8
		KLM-1049		1
		KLM-1050		16
		KLM-1061		1
10416420	1/6JTP 2.0K	KLM-783		1
10416422	1/6JTP 2.2K	KLM-780		1
		KLM-783		2
		KLM-1049		1
10416427	1/6JTP 2.7K	KLM-1049		1
10416430	1/6JTP 3.0K	KLM-783		1
10416433	1/6JTP 3.3K	KLM-780		1
		KLM-781		2
		KLM-783		3
		KLM-1050		4
10416439	1/6JTP 3.9K			2
10416447	1/6JTP 4.7K	KLM-781		1
		KLM-783		1
		KLM-1050		12
10416451	1/6JTP 5.1K	KLM-782		3
10416462	1/6JTP 6.2K			1
		KLM-783		2
10416468	1/6JTP 6.8K	KLM-782		1
		KLM-783		16
10416475	1/6JTP 7.5K			2
10416491	1/6JTP 9.1K			1
		KLM-1050		4
10416510	1/6JTP 10K	KLM-780		4
		KLM-781		9
		KLM-782		7
		KLM-783		40
		KLM-1049		2
10416511	1/6JTP 11K	KLM-782		1
		KLM-1050		4
10416512	1/6JTP 12K	KLM-782		9
		KLM-1050		30
10416515	1/6JTP 15K			2
10416516	1/6JTP 16K			2
10416518	1/6JTP 18K	KLM-783		9
		KLM-1049		2

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
10416518	1/6JTP 18K	KLM-1050		10
10416520	1/6JTP 20K	KLM-782		1
		KLM-1050		2
10416522	1/6JTP 22K	KLM-783		1
		KLM-1050		2
10416527	1/6JTP 27K	KLM-780		1
		KLM-783		24
		KLM-1050		22
10416530	1/6JTP 30K	KLM-781		2
		KLM-783		8
10416543	1/6JY 43K	KLM-782		1
10416547	1/6JTP 47K	KLM-781		2
		KLM-783		8
10416568	1/6JTP 68K	KLM-780		1
		KLM-783		1
10416610	1/6JTP 100K	KLM-780		1
		KLM-781		2
		KLM-783		27
		KLM-1049		1
		KLM-1050		12
10416615	1/6JTP 150K	KLM-783		8
10416618	1/6JTP 180K	KLM-780		1
10416620	1/6JTP 200K	KLM-1050		2
10416622	1/6JTP 220K			4
10416627	1/6JTP 270K	KLM-781		1
10416633	1/6JTP 330K	KLM-1049		1
10416647	1/6JTP 470K	KLM-782		1
10416656	1/6JTP 560K	KLM-780		1
		KLM-783		8
10416710	1/6JTP 1.0M	KLM-780		1
		KLM-783		1
		KLM-1050		6
10416739	1/6JY 3.9M	KLM-782		1
	METAL FILM RESISTORS			
12513499	1/6 499 OHM	KLM-782		1
12514158	1/6 1.58K	KLM-783		1
12514210	1/6 2.1K			1
12514267	1/6 2.67K	KLM-781		2
12514274	1/6 2.74K	KLM-783		1
12514280	1/6 2.80K			1
12514294	1/6 2.94K			1
12514499	1/6TP 4.99K	KLM-786/10		1
12514536	1/6 5.36K	KLM-781		2
12514604	1/6TP 6.04K			1
12514698	1/6 6.98K	KLM-782		1

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
12514953	1/6 9.53K	KLM-781		1
12514976	1/6 9.76K	KLM-782		1
12515100	1/6TP 10.0K			2
12515147	1/6TP 14.7K	KLM-786/10		1
12515150	1/6 15.0K	KLM-781		3
12515200	1/6TP 20.0K	KLM-782		2
12515301	1/6TP 30.1K	KLM-781		1
12515332	1/6TP 33.2K	KLM-786/10		1
	BLOCK RESISTORS			
13504510	RKC1/8B4J 10K	KLM-782		1
13505510	RKC1/8B5J 10K	KLM-783		1
13507510	RKC1/8B7J 10K	KLM-782		1
13508333	RKC1/8B8J 330 OHM	KLM-780		1
13508510	RKC1/8B8J 10K	KLM-780		4
		KLM-781		5
		KLM-782		1
13511510	RKC1/8B11J 10K			1
13704410	RKC1/8B4SJ 1K	KLM-781		2
13807002	RNBQEL001A	KLM-1050		2
	THERMISTOR			
18032410	TD5-C210DA	KLM-783		1
18032450	TD-C250DA			2
	MYLAR CAPACITORS			
20402410	50V 0.001UF	KLM-783		32
		KLM-786/10		1
		KLM-1050		2
20402412	50V 0.0012UF	KLM-783		1
20402422	50V 0.0022UF			8
		KLM-1050		4
20402427	50V 0.0027UF			4
20402439	50V 0.0039UF	KLM-783		1
20402447	50V 0.0047UF	KLM-782		1
20402456	50V 0.0056UF	KLM-1050		4
20402510	50V 0.01UF	KLM-781		1
		KLM-782		1
		KLM-784		1
		KLM-786/10		1
		KLM-1050		4
20402522	50V 0.022UF			6
20402527	50V 0.027UF	KLM-1061		16
20402547	50V 0.047UF	KLM-780		1
		KLM-783		1
		KLM-785/10		1
20402556	50V 0.056UF	KLM-783		16

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
20402612	50V 0.12UF	KLM-783		2
	STYROL CAPACITORS			
20503256	50V JT 56PF	KLM-1050		2
	CERAMIC CAPACITORS			
21452100	50V 10PF TP	KLM-780		4
21452220	50V 22PF TP	KLM-781		2
21452470	50V 47PF TP	KLM-782		1
		KLM-783		2
		KLM-1050		6
21453100	50V 100PF TP	KLM-781		1
		KLM-782		3
		KLM-783		1
		KLM-1050		4
21453150	50V 150PF TP	KLM-783		1
21453180	50V 180PF	KLM-782		4
21453220	50V 220PF TP	KLM-783		1
21453270	50V 270PF			1
21453330	50V 330PF TP	KLM-782		3
		KLM-784		2
		KLM-1050		4
21453470	50V 470PF TP	KLM-780		1
		KLM-783		1
		KLM-788		2
		KLM-1050		4
21453680	50V 680PF TP			4
21454100	50V 1000PF TP	KLM-782		16
21454470	50V 4700PF TP	KLM-780		1
21455100	50V 0.01UF TP	KLM-781		1
		KLM-782		2
21455470	50V 0.047UFTP	KLM-780		30
		KLM-781		29
		KLM-782		68
		KLM-783		34
		KLM-784		5
		KLM-785/10		1
		KLM-786/10		6
		KLM-788		2
		KLM-1049		4
		KLM-1050		44
		KLM-1061		13
21456100	25V 0.1UF TP	KLM-782		6
		KLM-783		32
		KLM-788		1

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
	EMI FILTER			
21950100	DSS-310-55D223S	KLM-780		1
		KLM-781		5
		KLM-782		1
		KLM-783		2
		KLM-785/10		1
		KLM-1050		4
	TAMTALUM CAPACIAORS			
22407168	16V6.8UF	KLM-785/10		1
	ELECTROLYTIC CAPACITORS			
23907447	16V 4700UF	KLM-786/10		2
23911422	25V 2200UF			2
23911447	25V 4700UF			1
23917510	16V 10000UF			1
	BLOCK CAPACITORS			
24815247	40V 47PF×8	KLM-781		3
		KLM-782		2
	ELECTROLYTIC CAPACITORS			
25402347	10V 470UF	KLM-786/10		1
25403147	16V 4.7UF	KLM-780		1
25403210	16V 10UF	KLM-781		2
		KLM-782		5
		KLM-783		3
		KLM-1050		20
25403222	16V 22UF	KLM-783		17
		KLM-784		1
25403247	16V 47UF	KLM-781		1
		KLM-784		3
25403310	16V 100UF	KLM-780		1
		KLM-781		1
		KLM-782		3
		KLM-783		2
		KLM-784		1
		KLM-1050		6
25403322	16V 220UF	KLM-780		1
25404147	25V 4.7UF	KLM-784		2
		KLM-786/10		1
25404210	25V 10UF	KLM-782		5
25404310	25V 100UF	KLM-781		2
		KLM-782		6
		KLM-783		2
25406010	50V 0.1UF			8
25406022	50V 0.22UF	KLM-1050		4

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
25406110	50V 1UF	KLM-780		1
		KLM-783		2
		KLM-784		2
		KLM-786/10		2
		KLM-1049		1
		KLM-1050		2
25406122	50V 2.2UF	KLM-782		1
		KLM-786/10		2
25406122	50V 2.2UF	KLM-1050		16
25406133	50V 3.3UF	KLM-783		8
25453247	16V 47UF	KLM-1061		3
25463210	16V 10UF	KLM-782		2
		KLM-783		1
		KLM-784		1
		KLM-1050		6
25463222	16V 22UF	KLM-782		2
		KLM-783		2
25464147	25V 4.7UF	KLM-1049		1
25466110	50V 1UF	KLM-783		1
		KLM-1050		8
25466122	50V 2.2UF	KLM-783		16
TR				
30100425	2SB553 Y	KLM-786/10		1
30101000	2SB564	KLM-782		1
30202299	2SC2785 K SELECTED (SILVER)	KLM-783		1
30300900	2SD471	KLM-782		1
30400050	2SA1175	KLM-781		1
		KLM-785/10		2
		KLM-1050		6
30420070	2SC2785	KLM-781		3
		KLM-783		2
		KLM-784		3
		KLM-785/10		1
		KLM-786/10		1
DIGITAL TR				
30430010	DTA-114N	KLM-784		1
		KLM-1050		2
FET				
30460020	2SK381-34-B	KLM-1050		4
30460021	2SK381-34-C	KLM-784		1
30460110	2SJ40-34-C			1
BRIDGE DIODE				
31010200	4B4B41	KLM-786/10		3

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
31010400	6B4B41	KLM-786/10		1
LED				
31206700	SLP-981C-50	KLM-785/10		9
LCD				
31300300	GMD-20202EBG	LCD ASSY		1
DIODE				
31001500	SR1K-2	KLM-786/10		5
31400100	1S1555	KLM-784		9
		KLM-785/10		3
		KLM-786/10		2
31400300	1S-2473	KLM-785/10		20
		KLM-788		1
31401100	1SS-53	KLM-786/10		1
31401300	1SS-133	KLM-780		3
		KLM-781		4
		KLM-782		3
		KLM-783		8
		KLM-1049		1
		KLM-1050		12
ZENER DIODE				
31421900	RD4.7JSB2-T1	KLM-782		1
31422400	HZ-3ALL-TD	KLM-781		1
31423400	HZ-3CLL-TD	KLM-786/10		1
IC				
32001023	UPD-4066 BC	KLM-1050		2
32001067	74HC00C	KLM-782		5
32001069	74HC32C	KLM-781		1
		KLM-782		1
32001070	74HC74C	KLM-780		1
		KLM-782		1
32001071	74HC(40H) 138C	KLM-781		2
32001083	74HC374C			2
		KLM-782		4
32001085	UPD65010CW-113	KLM-1050		2
32001087	UPC319C	KLM-782		1
		KLM-1050		2
32001090	UPC311C			2
32001091	UPD4364C-15	KLM-780		2
		KLM-781		1
32001093	UPC398C	KLM-782		1
32001095	74HC174C			2
32001097	74HC04C			1

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
32001097	74HC04C	KLM-1061		3
32001098	UPD65011C-023	KLM-782	GATE ARRAY	2
32001099	UPD65030G-043-12		GATE ARRAY	1
32001100	UPD65040G-099-12		GATE ARRAY	2
32001101	74HC08C			2
32001105	UPD765AC	KLM-780		1
32001106	UPD8255AC-2			1
32001107	UPD8085AC-2			1
32001108	UPD8155HC-2			1
32001111	UPD41256V-15	KLM-782		12
32003070	TC9154P			1
		KLM-1050		2
32003017	TC9156AP	KLM-783		1
32003072	TC-74HC4066P	KLM-782		4
		KLM-1061		4
32003073	TC74HC77P	KLM-781		1
32003102	TC74HC02P			1
32003175	TC74HC245P			1
32003192	TC74HC365P	KLM-782		2
32004017	HD-14051 BP	KLM-781		1
		KLM-783		3
32004035	HD-7438 P	KLM-780		2
32004085	HD63B03X	KLM-781		1
32004095	HN4827128G-25			1
32004097	74HC240			1
32004098	HD14549B	KLM-782		1
32004099	HD14559B			1
32004101	74HC139P	KLM-781		1
32004110	HD7405P	KLM-788		1
32006021	MSM-82C53-5RS	KLM-782		6
32007017	BA9221	KLM-781		1
		KLM-782		2
32009001	NJM-4558D-V	KLM-781		2
		KLM-783		5
32009005	NJM-4558 S			4
		KLM-1050		10
32009011	NJM-7805 A	KLM-786/10		1
32009015	NJM-2903 D	KLM-781		1
32009021	NJM-7905 A	KLM-786/10		1
32009035	NJM5534-D	KLM-781		1
		KLM-782		1
32009043	NJM78L10K			1
32009048	NJM-7812	KLM-786/10		2
32009049	NJM-7912			1
32009052	NJM-2068 D			1
32009053	NJM-2069B-D	KLM-783		8

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
32011004	M-74LS04	KLM-780		2
32011005	M-74LS08			2
32011006	M-74LS32			2
32011007	M-74LS74			1
32011008	M-74LS139			1
32011010	M-74LS373			1
32011014	M-74LS138			1
		KLM-782		2
32011015	M-74LS374	KLM-780		2
32011020	M5224P	KLM-783		6
		KLM-1049		1
32011025	M-54513P	KLM-780		1
32011026	M-5216 L	KLM-784		1
32011047	M5218P	KLM-1050		8
32011051	M74LS14P	KLM-780		1
32011060	M74LS367			2
32011062	M74LS245P			2
32011064	M5M4416P	KLM-1050		4
32011074	M5219L	KLM-782		5
32011075	M5220L			1
32011076	M5238L			8
		KLM-1061		8
32011077	M5201P	KLM-783		8
32011078	M74LS05P			1
32012003	MBM-2764-25Z	KLM-780		1
32012017	MBM27256-25			2
32013001	PST-518			1
32014001	SED9420C			1
32023005	S-8054HN	KLM-781		1
32025003	NE572N	KLM-1050		2
PHOTO COUPLER				
33001000	TLP-552	KLM-788		1
CRYSTAL OSCILLATOR				
33502600	HC-18/U 16	KLM-780		1
CERAMIC OSCILLATOR				
33502700	PRT-8.0RM0	KLM-781		1
33502800	PRT-10.0RM	KLM-780		1
TIME BASE MODULE				
33502900	KXO-01-20MHZ	KLM-782		1
33503000	KXO-01-32MHZ			1
P.C. BOARD				
34078000	KLM-780	KLM-780		1
34078100	KLM-781	KLM-781		1
34078200	KLM-782	KLM-782		1

34078200	KLM-782	KLM-782		1

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
34078300	KLM-783	KLM-783		1
34078400	KLM-784	KLM-784		1
34078500	KLM-785/1012/1013	KLM-785/10		1
34078600	KLM-786/1014	KLM-786/10		1
34078800	KLM-788	KLM-788		1
34310361	KLM-1036	KLM-1036F		1
34310490	KLM-1049	KLM-1049		0.25
34310500	KLM-1050	KLM-1050		2
34310610	KLM-1061	KLM-1061		1
	SEMI FIXED VRs			
35001247	H0651A 4.7KB	KLM-1050		2
35001315	H0651A 15KB			4
35002147	RH0615C S2 470K	KLM-782		1
35002222	RH0615C J3 2.2K	KLM-781		1
35002310	RH0615C 10K	KLM-786/10		1
35002315	RH0615C 15K	KLM-783		16
35002347	RH0615C 47K	KLM-1049		1
35002368	RH0615C W4 68K	KLM-783		8
35002410	RH0615C 100K			24
		KLM-1049		1
35002510	RH0615C 1M	KLM-783		1
	VRs			
36015600	K16200005 10KB			2
36019700	K091C0Z01 10KB	KLM-785/10		1
	SLIDE VRs			
36506300	RS30112A9 10KB×2	KLM-784		1
36506400	RS30111A9 10KB			3
	SLIDE SW			
37303900	R-S47836	KLM-788		1
	POWER SW.			
37508000	SW SDDJI			1
	TACT SW.			
37508500	SKHHAJ	KLM-784		4
		KLM-785/10		23
	POWER TRANSFORMER			
40010100	TC-020 (HT-			1
	COIL			
40202200	36640	KLM-788		11
		KLM-1036F		2
40202300	BLO2RN2-R62	KLM-781		2
		KLM-788		1

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
	INVERTER			
40202400	NEL-D32-46	KLM-785/10		1
	RELAY			
40301100	G5A237P 12V	KLM-784		1
	KEYBOARD			
42003200	ESK-903			1
	PRELOAD DISK			
43000100	KSD-001 MF2DD			1
43000200	KSD-002 MF2DD			1
43000300	KSD-003 MF2DD			1
43000400	KSD-004 MF2DD			1
	FLOPPY DISK DRIVE			
43500400	MD350			1
	PHONE JACK			
45404400	YKB21-5010	KLM-788		6
	FUSE			
46402201	125V 1.6A UL		117 US	1
			100JP	1
			117EX	1
			117CN	1
46402301	125V 2A UL		117 US	4
			100JP	4
			117EX	4
			117CN	4
46402501	125V 3A UL		117 US	1
			100JP	1
			117EX	1
			117CN	1
46402601	125V 4.0A UL		117 US	1
			100JP	1
			117EX	1
			117CN	1
46462201	250V T1.6A		220 GE	6
			220 SE	6
			240 AF	6
			240 AU	6
			240 GE	6
			220 WG	6
			220FR	6
			240UK	6
			220 SC	6
46462501	250V T3.15A		220 GE	1

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
46462501	250VT3.15A		220 SE	1
			240 AF	1
			240 AU	1
			240 GE	1
			220 WG	1
			220FR	1
			240UK	1
			220 SC	1
	HARNESS			
47061000	HNS-510 4P			1
47061100	HNS-511 14P	LCD ASSY		1
47061200	HNS-512 8P			1
47061300	HNS-513 12P			1
47061400	HNS-514 12P	KLM-781		
47061500	HNS-515 34P			1
47061600	HNS-516 8P	KLM-782		1
47061700	HNS-517 11P			1
47061800	HNS-518 9P			1
47061900	HNS-519 4P			1
47062000	HNS-520 7P			1
47062100	HNS-521 4P			1
47062200	HNS-522 4P	KLM-782		1
47062500	HNS-525 5P			1
47062600	HNS-526 13P	KLM-783		1
47062700	HNS-527 8P			1
47062800	HNS-528 7P			1
47063200	HNS-532 6P			1
47063300	HNS-533 8P			1
47063400	HNS-534 5P			1
47063500	HNS-535 5P			1
47063600	HNS-536 4P			1
47063700	HNS-537 5P			1
47063800	HNS-538 6P			1
47063900	HNS-539 6P			1
47064000	HNS-540 4P			1
47064100	HNS-541 4P			1
47064200	HNS-542 5P			1
47064300	HNS-543 6P			1
47064400	HNS-544 6P			1
47064500	HNS-545 4P	KLM-785/10		1
47064600	HNS-546 4P			1
47064700	HNS-547 4P	KLM-785/10		1
47064800	HNS-548 4P			1
47064900	HNS-549 8P	KLM-786/10		1

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
47065000	HNS-550 10P			1
47065200	HNS-552 4P	LCD ASSY		1
47066400	HNS-564 3P			1
47066500	HNS-565 3P			1
47066600	HNS-566 3P			1
47070700	HNS-607	KLM-782		1
47070800	HNS-608			1
47070900	HNS-609			1
47071000	HNS-610			1
47071100	HNS-611			1
47071200	HNS-612			1
47071300	HNS-613	KLM-782		1
	CONNECTOR			
47150400	B4P-VH	KLM-786/10		2
47150500	B5P-VH			1
47150600	B6P-VH			1
47150700	TOP B7P-VH			2
47150800	TOP B8P-VH			1
47151000	TOP B10P-VH			1
47170400	B4B-PH	KLM-780		1
		KLM-781		2
		KLM-782		1
		KLM-784		3
		KLM-785/10		4
		KLM-788		1
		KLM-1049		2
		KLM-1050		2
47170500	B5B-PH	KLM-781		3
		KLM-784		2
		KLM-786/10		1
		KLM-1050		2
47170600	B6B-PH	KLM-781		1
		KLM-784		4
		KLM-785/10		1
		KLM-788		2
		KLM-1050		2
47170700	B7B-PH	KLM-783		1
47170800	B8B-PH	KLM-780		2
		KLM-781		4
		KLM-783		1
		KLM-784		1
		KLM-785/10		1
47170900	B9B-PH	KLM-780		1
		KLM-783		1

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
47171100	B11B-PH	KLM-780		1
47171200	B12B-PH			2
		KLM-785/10		1
47171300	B13B-PH	KLM-781		1
47171400	TOP B14B-PH	KLM-780		1
47190200	TOP 5096-02C	KLM-1036F		3
47250400	B4PS-VH	KLM-780		1
47250500	SIDE B5PS-VH	KLM-783		1
47250700	SIDE B7PS-VH	KLM-781		1
		KLM-782		1
47250800	SIDE B8PS-VH	KLM-786/10		1
47251000	SIDE B10PS-VH			1
47270600	S6B-PH	KLM-1061		1
47270700	S7B-PH			3
47270900	SIDE S9B-PH			3
	HEADER			
47409410	PS-34PE-D4T1-PN1	KLM-780		1
47409500	AMP 171825-4	KLM-786/10		1
	IC SOCKET			
48001282	28P DICA-28CTI	KLM-780		3
		KLM-781		1
	DIN JACK SOCKET			
48010180	(×3) M-1704	KLM-788		1
	FUSE HOLDER			
51502300	S-N5057 #01	KLM-786/10		12
		KLM-1036F		2
	BUSHING			
54005801	TA-307			8
54005802	TA-310			2
54005900	TB-300			8
	TEST PIN			
54007100	LC-2-G-YELLOW	KLM-781		3
		KLM-782		4
		KLM-783		2
		KLM-786/10		1
		KLM-1050		6
		KLM-1061		2
	WIRE BAND			
54007200	PLT-1M			21
	ISOLATING WASHER			
54007300	B-1725K	KLM-786/10		3

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
	SPIRAL CLIP			
54008600	CS-8			1
	INLET SOCKET			
54010900	PA-126			1
	CLUMP			
54011100	CK-07H			2
	PUSH REVET			
54012500	P-5055			1
	SUPPORT RAIL			
54012600	CSR-23 L = 236.5			1
54012700	CSR-27 L = 273			1
	P.C.B. HINGE			
54012800				5
	PCB SPACER			
54012900	EHCBS-16N			5
	CK CLUMP			
54013000	CK-10H			2
	FELT			
55003800	8×25			2
	FELT FOR CONTROL PANEL			
55008200				1
	RADIATOR			
56003500	MT-C004 L = 25MM	KLM-786/10		1
56003600	FUG202A C-221 L = 50MM			1
	RADIATION SHEET			
56500300	BFG-30			3
	LED HOLDER			
57503800	X-TYPE NO2 4.8MM	KLM-785/10		9
	FCC LABEL			
58021000			117 US	1
	FTZ LABEL			
58021700			220 WG	1
	WIRING CAUTION FOR 2 PINS			
58023400			240UK	1
	PANEL EARTH FOR EMI			
58024200			117 US	2
			220 WG	2

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
	SHIELDING SHEET (EMI)			
58024300			117 US	4
			220 WG	4
	ALUMI SHEET			
58024400	LARGE FOR EMI			2
58024500	SMALL FOR EMI			2
	AC CORD			
60002100	SPT-2 UC-695-S01		117 US	1
			117EX	1
60002200	CEE EC-215-S01		220 GE	1
			240 AF	1
			240 GE	1
			220 WG	1
			220FR	1
			220 SC	1
60002300	SAA SC-455-S01		240 AU	1
60002400	DC-325-S01		100JP	1
60002500	BS BH-115-S01		240UK	1
60002600	CSA UC-707-S01		117CN	1
60002900	SE EX-221-A01		220 SE	1
	JOYSTICK LEVER KNOB			
62015800	NO.2 BLK			1
	SLIDE VR KNOB			
62016300				4
	KNOB			
62016400	X-501 NTS KNOB A			9
62016600	X-400 NTS KNOB B			18
	LCD WINDOW			
63002900	T=3			
	SHIELDING SHEET			
63003000				2
	SHIELDING SHEET (SMALL)			
63003400				1
	JOY STICK			
64058400	Y-SUPPORT			1
64058402	LEVER FIX PIN			2
	FRONT PANEL			
64076700				1
	FRONT CHASSIS			
64076800				1

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
	JOINT OF FRONT PANEL			
64076900				4
	JACK PLATE			
64077000				1
	SIDE CHASSIS L			
64077100				1
	SIDE CHASSIS R			
64077101				1
	METAL FITTING OF FDD			
64077200				1
	CONTROL PANEL SUPPORT			
64077300				1
	METAL FITTING OF P.C.BOARD			
64077400				2
	GND CLIP			
64077500				4
	RADIATION PLATE			
64077600		KLM-786/10		1
	PANEL SUPPORT			
64077800				2
	P.C.BOARD STUD			
64079400	#1 BSBMZ			3
64079500	#2 BSBMZ			4
	BOTTOM PLATE			
64508800				1
	JOY STICK BOX			
64610100				1
	JOY STICK X-SUPPORT			
64610101				1
	SLIDE VR ESCUTCHEON			
64622000				4
	SIDE PANEL L			
64622200				1
	SIDE PANEL R			
64622201				1
	CONTROL PANEL			
64622300				1

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
JOY STICK LEVER BLACK				
64622400				1
WIRE				
66010005	UL1007 AWG18 GRN			3
LUG				
67200201	4PHY N3			9
		KLM-786/10		3
67201600	4PHY N3			8
SERIAL NO. SEAL				
68599999				1
GUARANTEE SEAL				
68602500			100JP	1
NAME PLATE				
68600700			117 US	1
			117EX	1
68603100			220 GE	1
			220 SE	1
			240 AF	1
			240 AU	1
			240 GE	1
			220 WG	1
			220FR	1
			240UK	1
			117CN	1
SCREW				
70530305	FE B ZMC 3×5			4
70530306	FE B ZMC 3×6			8
70530308	FE B ZMC 3×8			43
70560308	FE B BZMC 3×8			4
70560325	FE BZMC 3×25			4
70560408	FE B BZMC 4×8			8
70760412	FE FEW BZMC 4×12			4
70760416	FE FEW BZMC 4×16			30
70760516	FE FEW BZMC 5×16			3
71530310	TP1 B ZMC 3×10			6
71530322	TP1 B ZMC 3×22			10
72530308	TP2G B ZMC 3×8			23
72530314	TP2G B ZMC 3×14	KLM-786/10		1
72560308	B BZMC 3×8		117 US	7
			220 GE	7
			220 SE	7
			240 AF	7

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
72560308	B BZMC 3×8		240 AU	7
			240 GE	7
			220 WG	7
			100JP	5
			117EX	7
			220FR	7
			240UK	7
			117CN	7
			220 SC	7
74560308	PLAX B BZMC 3×8			21
WASHER				
78130300	WK ZMC 3		117 US	4
			220 WG	4
78690300	PSW 3			1
78690500	PSW 5			2

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